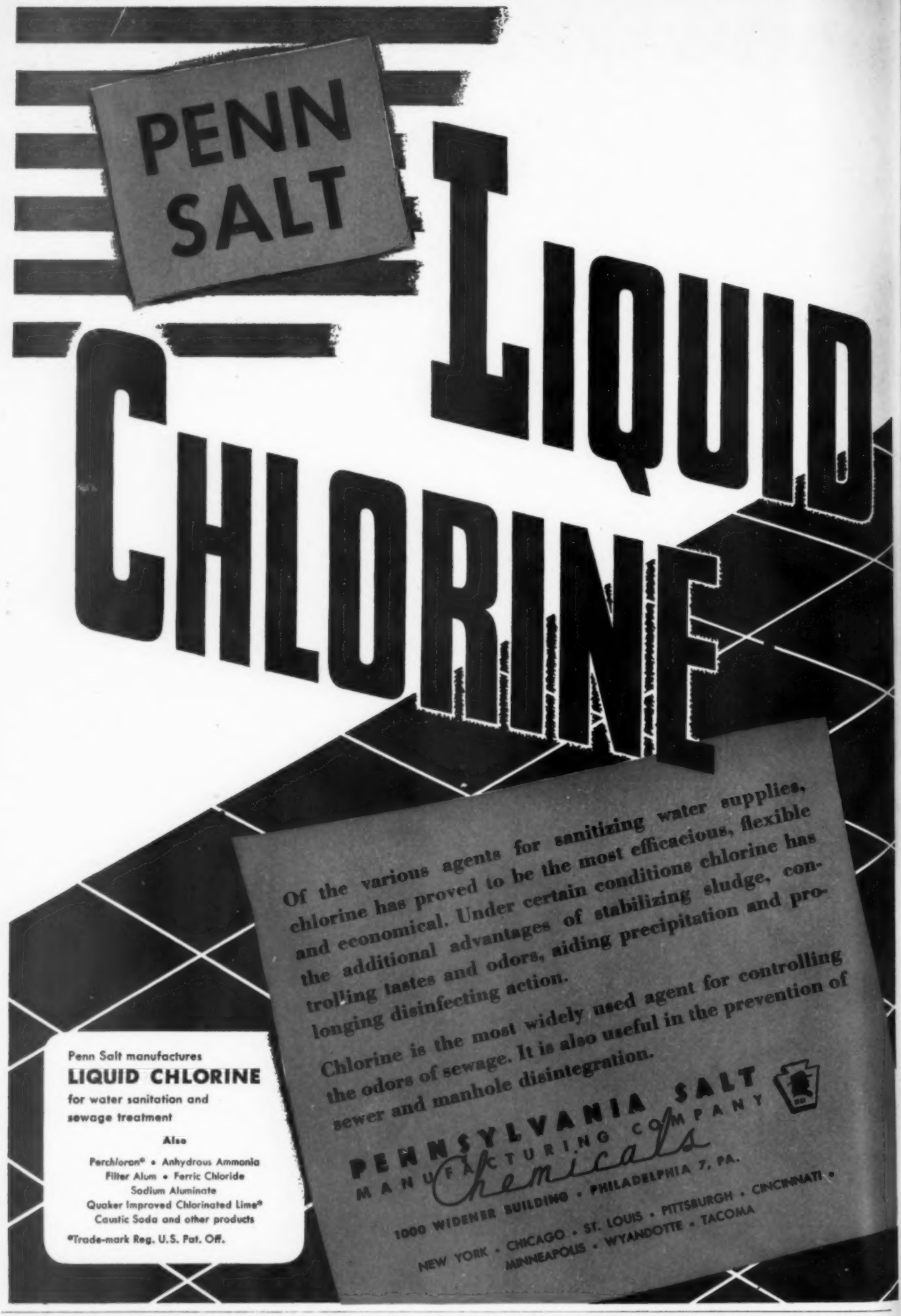
WATER & SEWAGE WORKS

ABP ABC

PILOT WASTE-TREATMENT PLANT

Operating on Strawboard Wastes at Terre Haute Paper Co's Plant, Terre Haute, Ind.


PENN SALT
LIQUID CHLORINE
Of the various agents for sanitizing water supplies, chlorine has proved to be the most efficacious, flexible and economical. Under certain conditions chlorine has the additional advantages of stabilizing sludge, controlling tastes and odors, aiding precipitation and prolonging disinfecting action.
Chlorine is the most widely used agent for controlling the odors of sewage. It is also useful in the prevention of sewer and manhole disintegration.
PENNSYLVANIA SALT MANUFACTURING COMPANY
Chemicals
1000 WIDENER BUILDING • PHILADELPHIA 7, PA.
NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • CINCINNATI • MINNEAPOLIS • WYANDOTTE • TACOMA
Penn Salt manufactures
LIQUID CHLORINE
for water sanitation and sewage treatment
Also
Perchloron* • Anhydrous Ammonia
Filter Alum • Ferric Chloride
Sodium Aluminate
Quaker Improved Chlorinated Lime*
Caustic Soda and other products
*Trade-mark Reg. U.S. Pat. Off.

WATER AND SEWAGE WORKS, July, 1946, Volume 93, Number 7. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.

UNINTERRUPTED FLEXIBLE AERATION

to meet

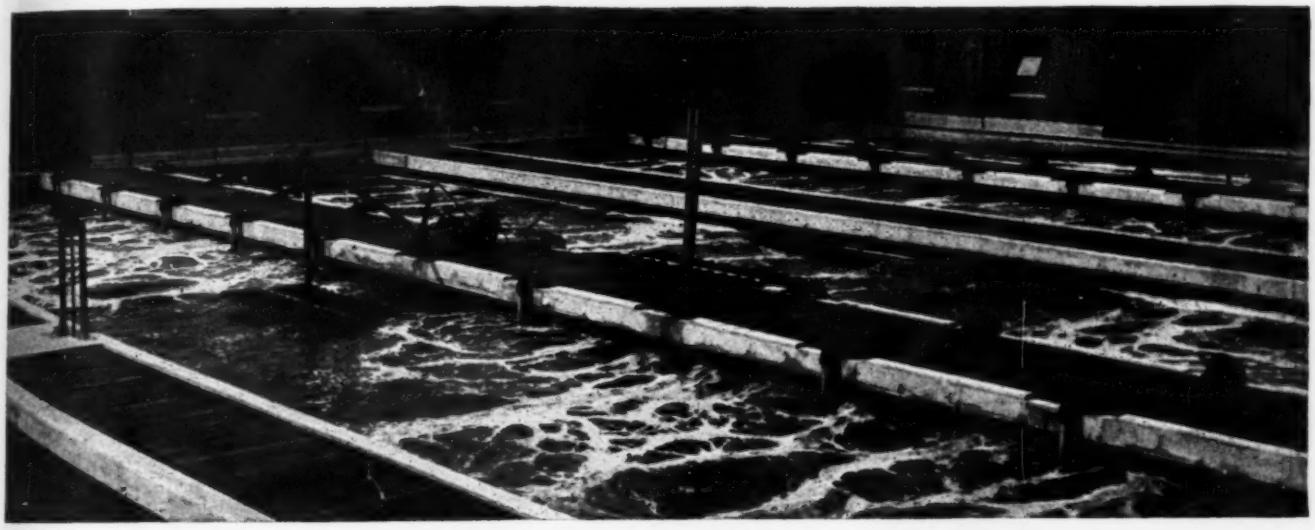
VARIABLE OPERATING CONDITIONS

SOLVED

....through intensive engineering application

with

CHICAGO WIDE BAND SWING DIFFUSERS*



Chicago Wide Band Air Diffusion System with Swing Diffusers at Omaha, Neb., Sewage Treatment Plant.

OVER 100 SUCCESSFUL INSTALLATIONS

FLEXIBILITY: Swing Diffusers can be raised to the tank walk for tube cleaning and for simple re-arrangement of diffuser tube spacing to conform with oxygen demand without de-watering tank or interrupting operation.

EFFICIENCY: Chicago Wide Band Air Diffusion System provides greater oxygen absorption—eliminates center coring—less air for optimum circulation — power economy through reduced hydrostatic head on elevated diffuser tubes.

*Patented

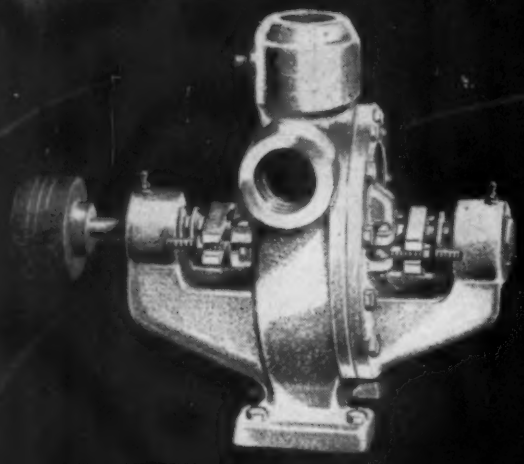
CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

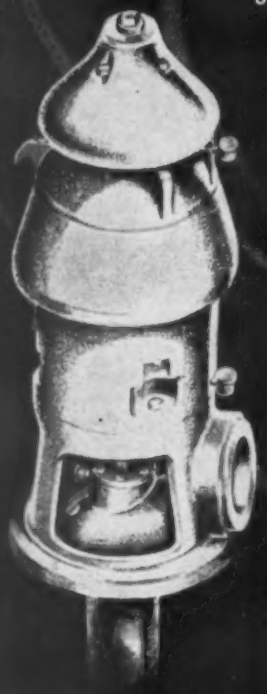
Flush-Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.



THE WESTCO LINE of precision-built pumps: unique advantages in long-life and varieties of use for small-capacity pumping of all types of liquids. High heads, low speeds.

FAIRBANKS-MORSE split-case centrifugals are first in their class for sustained high efficiency.



FOR VERTICAL TURBINE WORK—the complete line of Fairbanks-Morse and Pomona turbine pumps. At home—and well-proved—in farm or factory.

Impartially Yours . . .

for lower cost fluid-handling

When you are after lower cost liquid-moving, you want 100% impartial advice from men with second-to-none records of applying the right pump to all types of water-handling jobs! For this kind of engineering service—*and for a complete line from which you may choose*—there's no substitute for Fairbanks-Morse. Here's a single source for all your centrifugal, turbine, and special pumping needs—one "pump store" to simplify your pump-selection and servicing problems to the vanishing point!

IF YOU'RE AFTER any of these advantages, see your Fairbanks-Morse dealer or call the nearest Fairbanks-Morse office.

FAIRBANKS-MORSE

A name worth remembering

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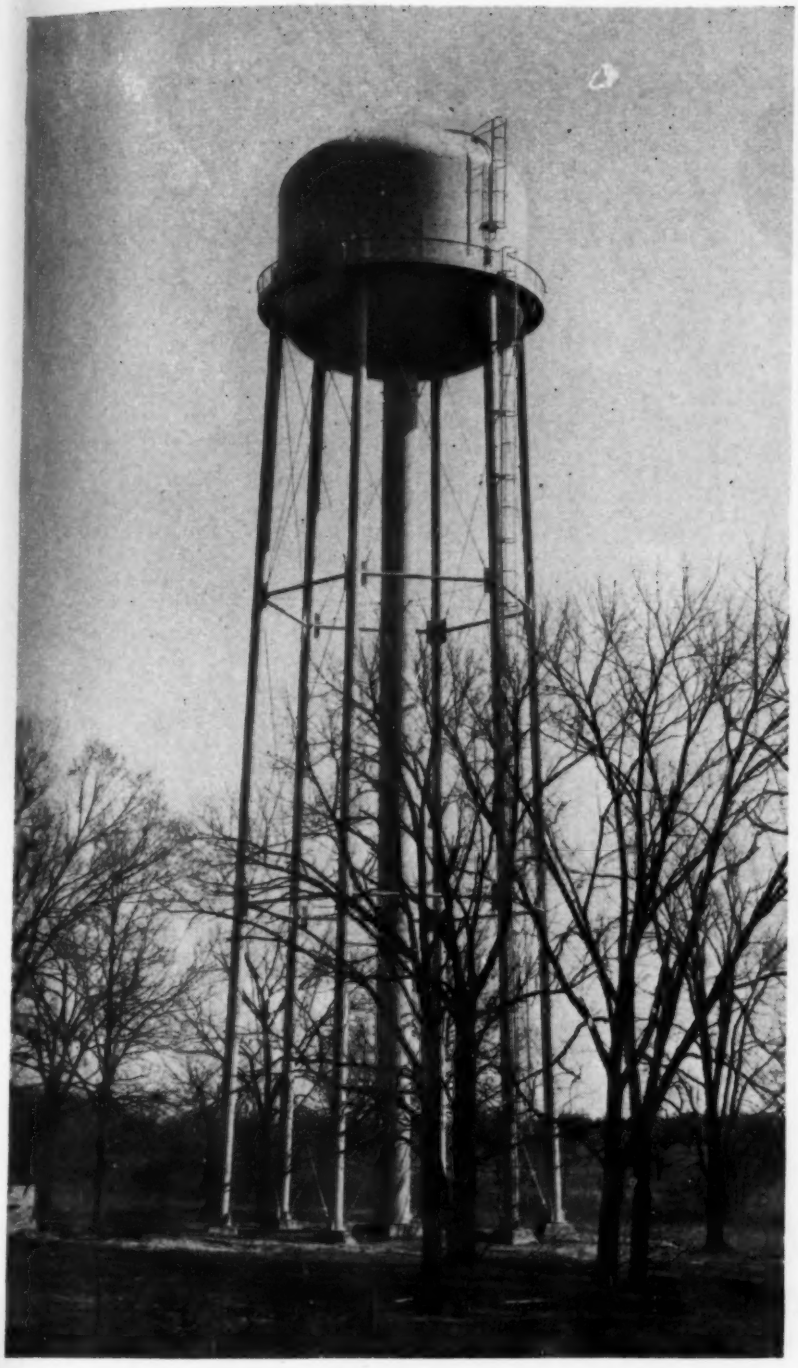
SCALES · STOKERS · RAILROAD MOTOR CARS and STANDPIPES · FARM EQUIPMENT



Modern

HORTON ELEVATED STORAGE

. . . now serves Coldwater State Home and Training School at Coldwater, Michigan

SEVENTY-TWO years ago, when the Coldwater State Home and Training School was opened, the water system consisted of a "bricked-up" well 34 ft. deep by 6 ft. wide and a tank located on the third floor of the Administration Building. About 1900, a 10,000-gal. wooden tank was installed in a brick tower. This provided gravity pressure in the water system until 1936, when a 50,000-gal. elevated tank was built. The *modern* 200,000-gal. Horton elevated tank shown at the left was recently erected to supplement the 50,000-gal. tank. It has cylindrical columns and is 125 ft. to bottom.

The water distribution system at this institution is not unlike that of a small municipality. The area served, 1074 acres, includes 53 buildings. The water is taken from wells and is pumped into the elevated tank. Approximately 7,000,000 gals. of water are used per month for general service, including fire protection. There are 16 fire hydrants in the system. At the present time 6400 ft. of 8-in. pipe, and 1200 ft. of 3-in. and 4-in. pipe connect the elevated storage to the various buildings. An extension program calls for an additional 1800 ft. of 8-in. water main for connecting up new wells.

The benefits of Horton elevated water storage are present in both large and small water distribution systems. They include (1) more uniform distribution pressures, (2) provision for pumping during off-peak periods and (3) an adequate reserve immediately available for fire protection. Water works engineers planning additions to or improvements in existing water distribution systems are invited to write our nearest office for quotations on Horton elevated water storage tanks. Please state capacity required, height to bottom and proposed location.

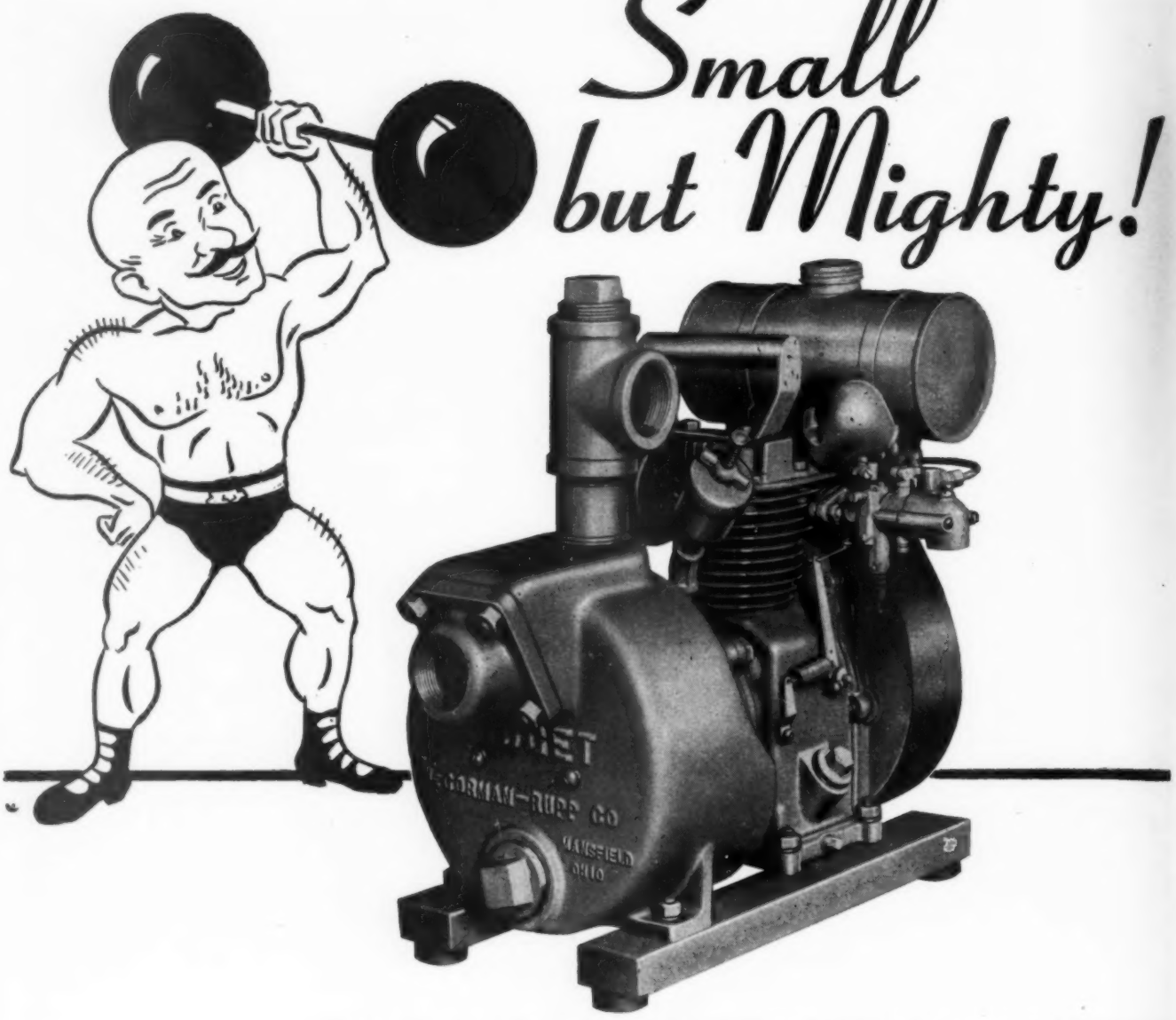
CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th Street
Atlanta 3.....2181 Healey Bldg.
Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Washington 4.....703 Atlantic Bldg.
San Francisco 11.....1283-22 Battery St. Bldg.
Detroit 26.....1551 Lafayette Bldg.

Plants in Birmingham, Chicago and Greenville, Pa.

In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

Small but Mighty!



PUMPS SIX TIMES ITS WEIGHT IN WATER
Each Minute of Operation

The Gorman-Rupp "Midget", weighing only 60 pounds, will pump 3000 gallons per hour against a 20 foot head and will do it for months at a time without attention.

The toughest little pump you ever saw and simple to operate -- no valves -- no priming by-passes or other tricks to learn. Fully automatic self-priming -- muck or solids will not clog it.

Gorman-Rupp self-priming centrifugal pumps are made in any size or capacity up to 125,000 gallons per hour and will out-perform any other pump on the market. Our nearest distributor will send you one and let you be the judge.

For Details call your nearest distributor.

THE GORMAN-RUPP COMPANY

GORMAN-RUPP PUMPS — UNSURPASSED FOR PUMPING FAST

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Personal pride in PRECISION PRODUCTION

WITH the pride of watchmakers, Badger craftsmen produce the many precision parts used in Badger Water Meters. That is one reason why years of accurate metering are yours when you use Badger Meters.

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Street Address _____

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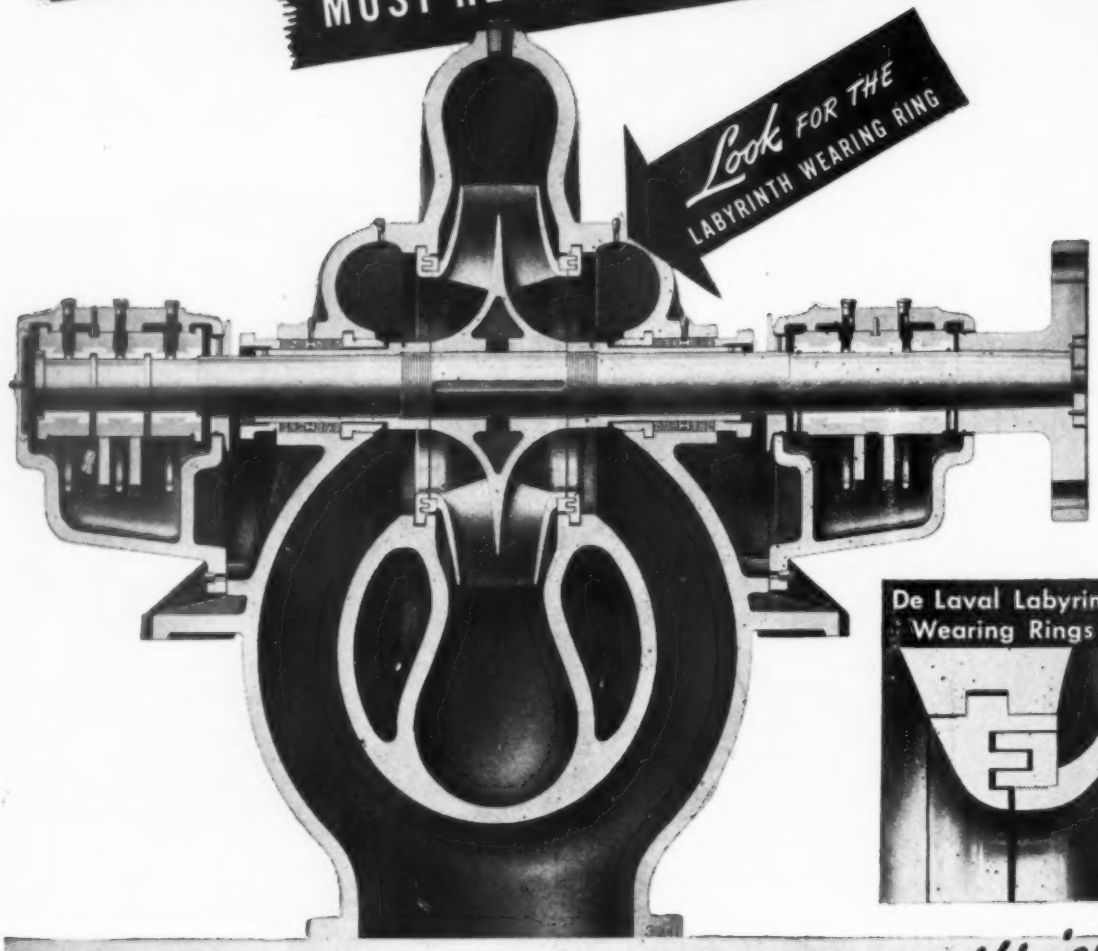
THE PUMP YOU BUY *TODAY*

MUST HELP MEET COMPETITION *TOMORROW*

Look FOR THE LABYRINTH WEARING RING



DE LAVAL LABYRINTH RINGS *keep efficiency UP cost DOWN*

De Laval Labyrinth Wearing Rings minimize leakage from discharge back to suction. The sealing action of these rings is accomplished by the use of large clearance, tortuous labyrinth passages and does not depend upon close mechanical clearances, such as required for plain flat rings. Because of the larger clearances and reduced flow, the effectiveness of the De Laval labyrinth ring is but little diminished by wear, resulting in sustained efficiency for long periods. When selecting pumps for lowest ultimate cost, look for the De Laval Labyrinth Wearing Ring.

3237

TURBINES · HELICAL GEARS
WORM GEAR SPEED REDUCERS
CENTRIFUGAL PUMPS · CENTRIFUGAL BLOWERS and COMPRESSORS · IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

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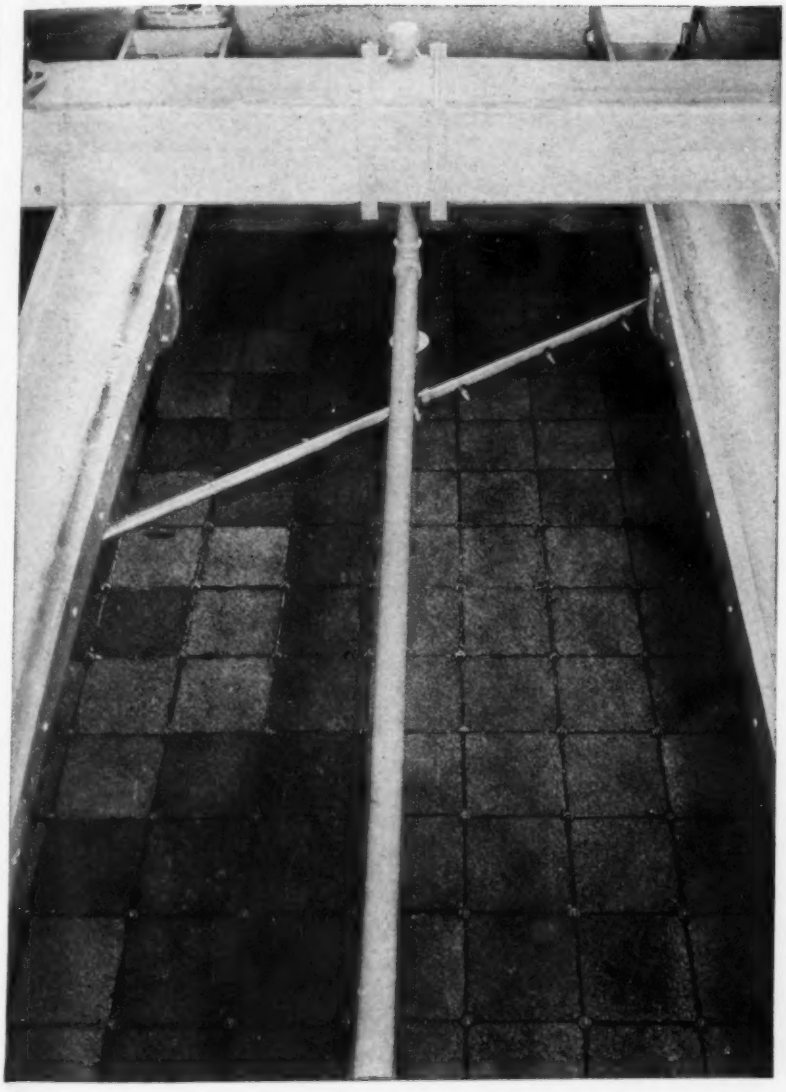
LYONS, N. Y. Modernizes Water Filtration System



THE operating efficiency and economy provided by ALOXITE aluminum oxide porous plates is once again effectively demonstrated in this installation at Lyons, N. Y.

Before modernizing the two filters in this plant... each with a capacity of ½ MGD... the old type sand and graded gravel beds were used. Service was very unsatisfactory... maintenance costs were high. A complete shutdown for the tedious job of screening and grading sand and gravel was a regular necessity. This task was further complicated by troublesome mudballs that formed in the sand and had to be washed away.

These expensive troubles and several others equally bothersome vanished entirely with the installation of ALOXITE porous underdrain plates. Graded gravel was eliminated. The displacement problem was licked. The depth of the sand filter was increased from 24″ to 30″ without changing construction design. In addition, metal parts such as spray nozzles, laterals and manifolds, which corroded and caused frequent, time-consuming shutdowns, have been eliminated. There is no longer a need to suspend operations for their replacement or repair.

Thorough backwashing, lasting only 7 minutes, uses but 2,000 gallons of water per minute. Thus, still another saving has been effected. During backwashing the sand over the ALOXITE plates expands only half that previously recorded. This operation is carried on after runs ranging from 120 hours normally to not less than 30 hours depending on the time of year.

The growing popularity of ALOXITE porous plates is attested by the expanding list of users. The many benefits claimed are verified in dozens of installations which practically duplicate the experience of Lyons. So, if you are planning plant modernization or new construction, you too will want all the facts. One of our technical staff will be glad to discuss details at your convenience. You need only write Dept. O-76, The Carborundum Company, Refractories Division, Perth Amboy, N. J.

Underdrain Plates

BY CARBORUNDUM

TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

YOUR ASSURANCE OF MAXIMUM PERFORMANCE

4-POINT CONTACT

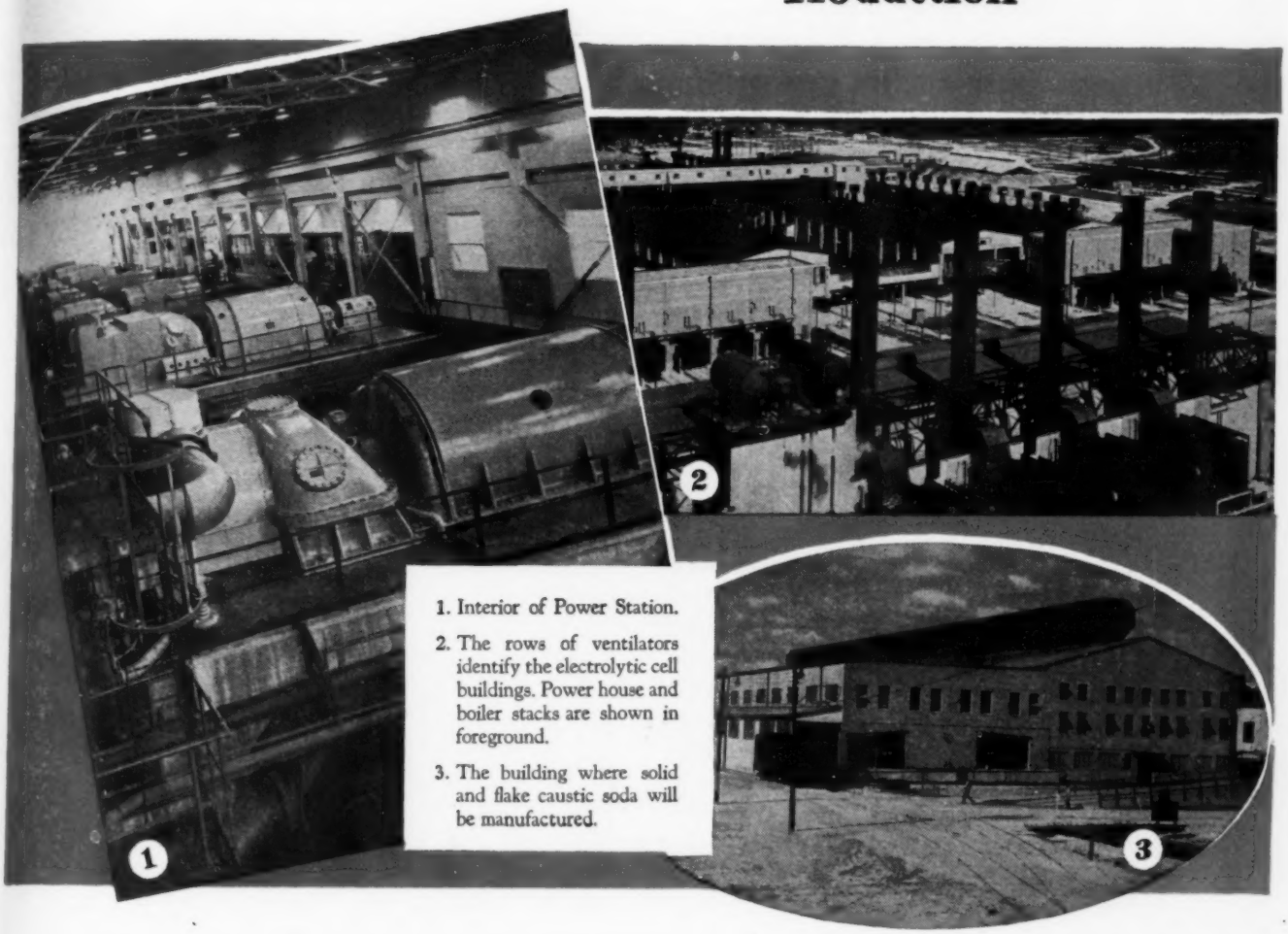
4-POINT CONTACT

MUELLER-COLUMBIAN Gate Valves have established a brilliant record of dependable and low cost operation—a record established because of their basically sound design and construction. In these parallel seat, double disc valves, the wedging action is applied equally at FOUR POINTS near the edges of the discs which reduces the mechanical strain and prevents sprung discs. The valve may be operated upside down or in any position in the line with equal efficiency.

This is only one of many desirable features that have made MUELLER-COLUMBIAN the choice of leading water works men for many years. The extensive engineering facilities, experience and advice of Mueller Co. are at your disposal. Ask any Mueller Representative for complete details or write direct.

MUELLER CO., CHATTANOOGA, TENN.
DECATUR, ILL. LOS ANGELES, CALIF.

Lake Charles Plant will increase *Caustic Soda—Chlorine* Production



1. Interior of Power Station.
2. The rows of ventilators identify the electrolytic cell buildings. Power house and boiler stacks are shown in foreground.
3. The building where solid and flake caustic soda will be manufactured.

Built to make wartime magnesium, "Lake Charles" is being converted to the manufacture of chlorine and caustic soda. While actual production will not start until some time next year, the existence of certain vital facilities permits an earlier start than would be possible by constructing an entirely new plant. "Lake Charles" will be operated by The Southern Alkali Corporation—a Pittsburgh Plate Glass Company affiliate. Located in Louisiana, this plant adds an important link to a cross-the-country group of facilities, all strategically located to serve industry efficiently and economically. This group includes a Texas Plant at Corpus Christi—owned by The Southern Alkali Corporation—and Columbia plants at Barberton, Ohio, Natrium, W. Va., and Owens Lake, Calif.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY

COLUMBIA CHEMICAL DIVISION

FIFTH AVENUE at BELLEFIELD, PITTSBURGH 13, PENNSYLVANIA · Chicago · Boston · St Louis Pittsburgh · New York · Cincinnati · Cleveland · Philadelphia · Minneapolis · Charlotte · San Francisco

COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS
Soda Ash • Caustic Soda • Liquid Chlorine • Sodium Bicarbonate • Pittchlor (*Calcium Hypochlorite*) • Silene EF (*Hydrated Calcium Silicate*) • Calcium Chloride • Soda Briquettes (*Iron Desulphurizer*) • Modified Sodas • Caustic Ash • Phosflake (*Bottle Washer*) • CalceneT (*Precipitated Calcium Carbonate*)

HUNDREDS of communities throughout the Nation have learned by comparative installations that Clay Pipe is the only pipe that can be depended on to eliminate sewer gas damage. It is not uncommon to find Clay Pipe outlasting other materials by a margin of 5 to 1, and still going strong.

CLAY PIPE ELIMINATES SEWER GAS DAMAGE at lowest cost • per • year

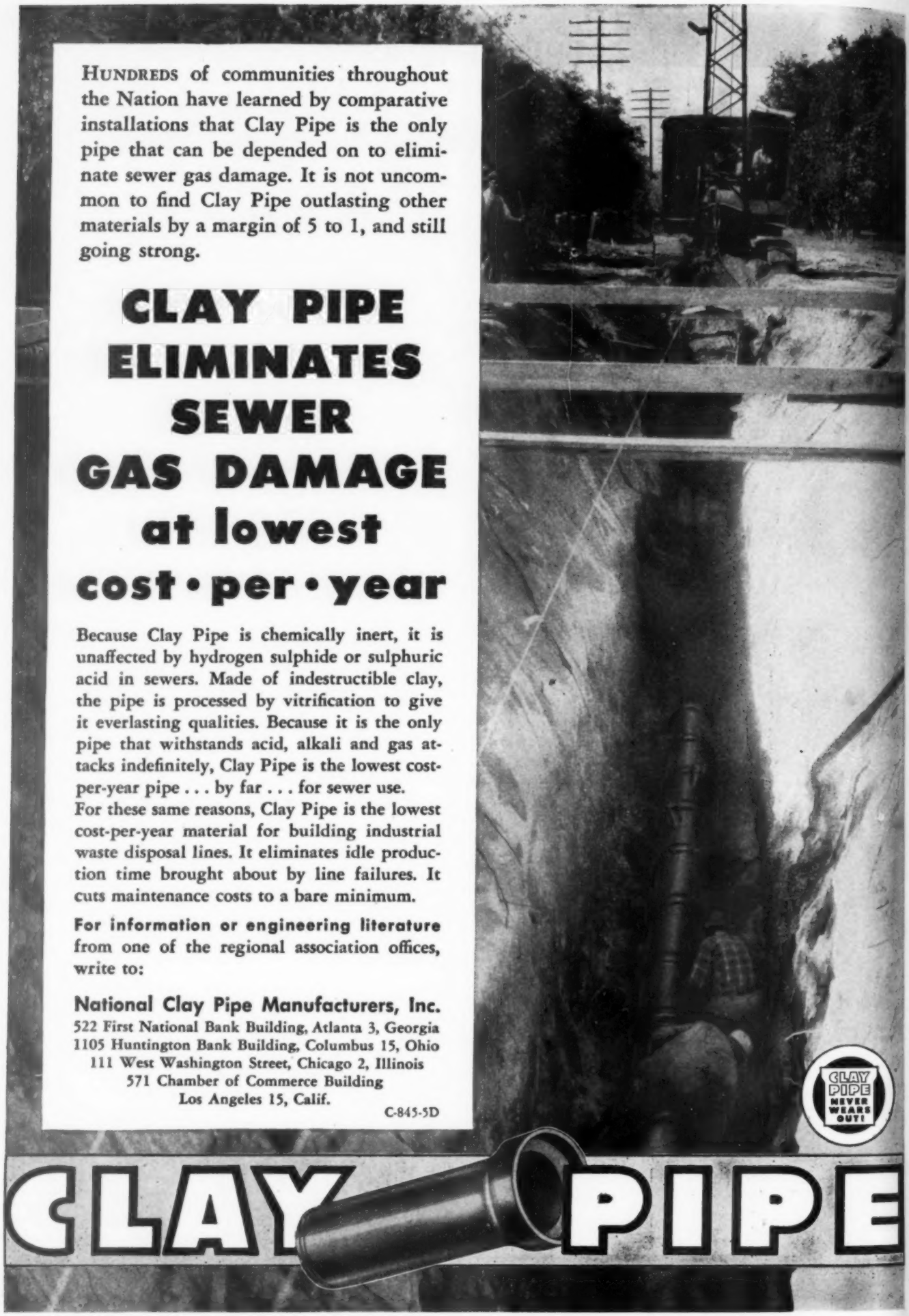
Because Clay Pipe is chemically inert, it is unaffected by hydrogen sulphide or sulphuric acid in sewers. Made of indestructible clay, the pipe is processed by vitrification to give it everlasting qualities. Because it is the only pipe that withstands acid, alkali and gas attacks indefinitely, Clay Pipe is the lowest cost-per-year pipe . . . by far . . . for sewer use.

For these same reasons, Clay Pipe is the lowest cost-per-year material for building industrial waste disposal lines. It eliminates idle production time brought about by line failures. It cuts maintenance costs to a bare minimum.

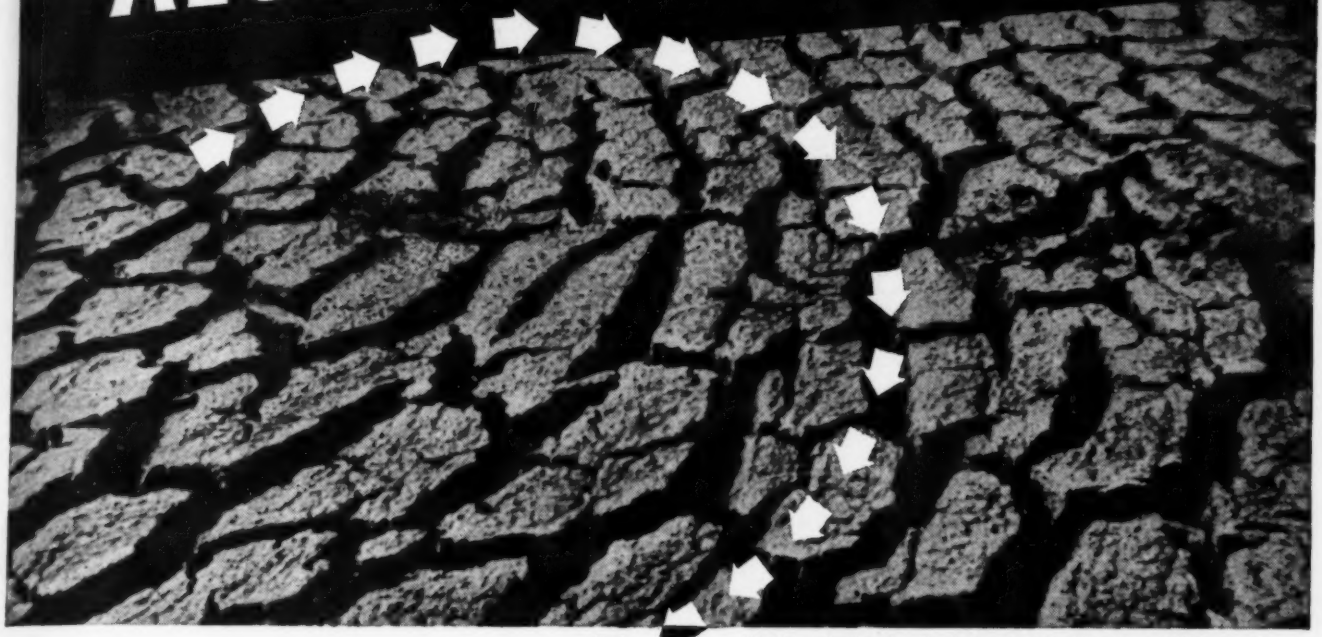
For information or engineering literature from one of the regional association offices, write to:

National Clay Pipe Manufacturers, Inc.
522 First National Bank Building, Atlanta 3, Georgia
1105 Huntington Bank Building, Columbus 15, Ohio
111 West Washington Street, Chicago 2, Illinois
571 Chamber of Commerce Building
Los Angeles 15, Calif.

C-845-5D



GENERAL CHEMICAL ALUMINUM SULFATE



Well cracked sludge bed shortly after Aluminum Sulfate treatment.

SPEEDS SLUDGE DRYING

General Chemical Alum speeds sludge dewatering and drying on sand beds . . . capacity of beds may be doubled, even tripled . . . quick removal lessens chance of odor nuisance . . . reduced volume of cake decreases cost of removal. Sewage works operators the nation over count on the benefits obtained from Alum treatment throughout the year.

Why not learn what General Chemical Alum will do in your plant too? Full information may be obtained quickly from the nearest General Chemical Sales and Technical Service Office listed below.

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GENERAL CHEMICAL COMPANY

FOR AMERICAN INDUSTRY

GENERAL CHEMICAL COMPANY

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In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

Announcing

the new RIDGID No. 4P Geared Threader for 2½" to 4" pipe

New ease of handling

New smoother, easier threading

New bother-free upkeep

New long life of efficient service

★

Quick-setting mistake-proof workholder

Loop handles make new 4P extra easy to put on pipe.

● Here's the new 2½" to 4" die stock you have been wanting. It's full of the work-saver advantages you expect of a RIDGID Pipe Tool.

Comfort-grip loop handles balance it easily—no slipping or tipping over. Easy to carry with one hand, easy to lift and put on pipe... RIDGID plate type workholder quickly sets to pipe size *before* you lift it, tightens on pipe with *one* screw—and no bushings to fool with or lose.

Easy upkeep, too—drive pinion shaft turns in oilless bronze bearing, never needs oil. Enclosed gear protects you, keeps out dirt. Drive pinion is solidly twin-anchored to face plate and gear housing; four sets of 5 high-speed steel chaser dies cut clean standard or tapered threads, drip threads, short nipples. RIDGID universal drive shaft available for power drive; ratchet handle with each threader.

It's RIDGID design and quality throughout—for great performance and durability. Write today for the whole story—see the new 4P at your Supply House.

Loop handles on gear cover for easy non-slip handling

★

Twin-anchored drive pinion-shaft turns in oilless bronze bearing

★

5 chaser dies

★

Fully enclosed gear

New 4P is extra easy to carry.

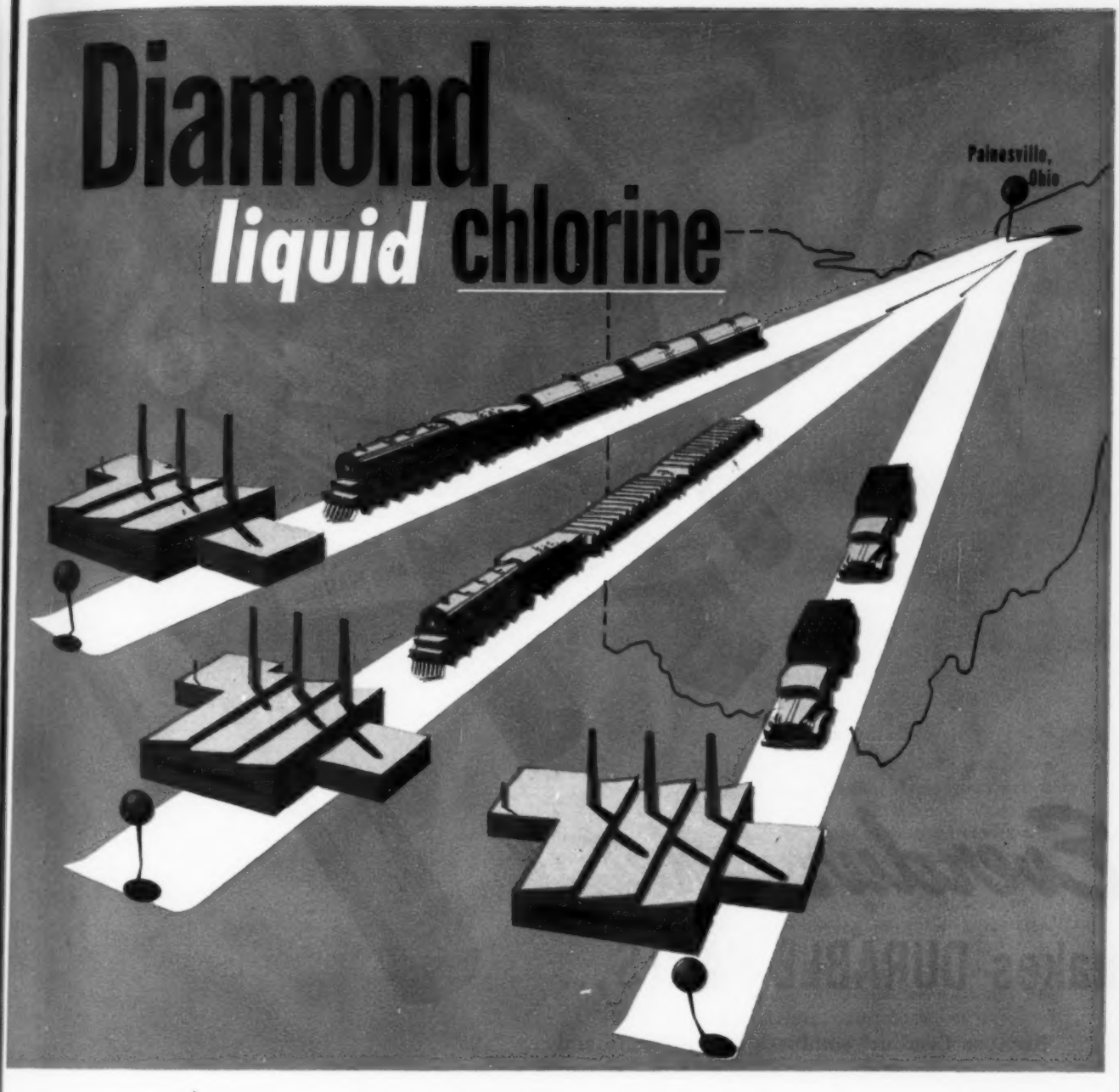
Millions of RIDGID Tools in use

★ RIDGID ★

WORK-SAVER PIPE TOOLS

The Ridge Tool Company
Elyria, Ohio, U. S. A.

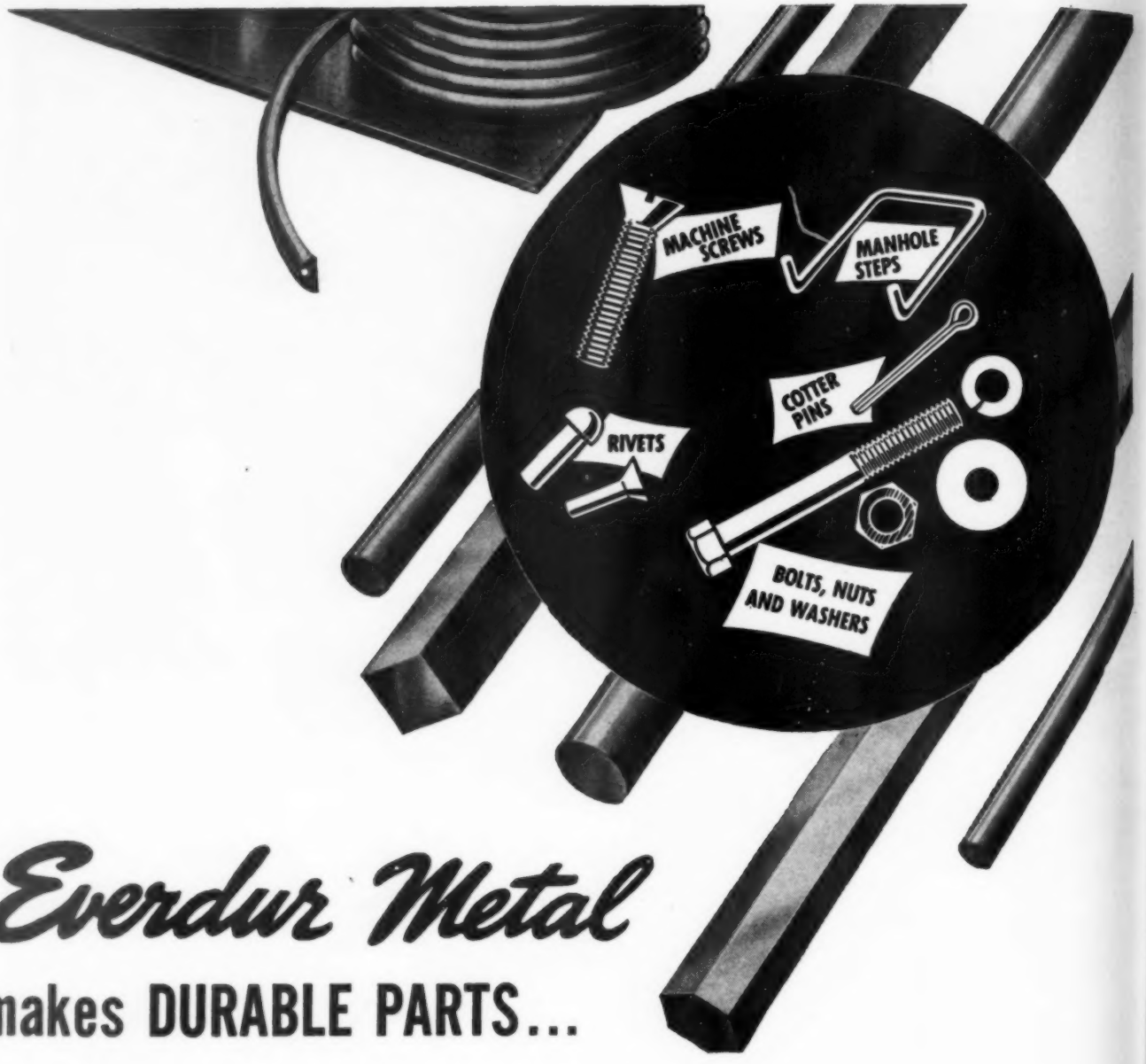
Diamond *liquid* chlorine



- highest quality
- available now
- **delivered** in tank cars, multi-unit cars, or cylinders, as your needs require

CHLORINE

Diamond Alkali Company, Pittsburgh, Pa., and everywhere



Everdur Metal

makes DURABLE PARTS...

BECAUSE Everdur* combines high strength and corrosion resistance with ready workability and weldability, these copper-silicon alloys have proven outstandingly durable in hundreds of water works and sewage installations throughout the country.

Available in practically all commercial shapes, and in compositions suitable for hot or cold working, machining or recasting, Everdur lends itself to efficient, economical production of parts such as those illustrated, as well as to lightweight, welded, built-up construction of major equipment.

Water works and sewage equipment constructed of Everdur is still in service and in excellent condition after constant use since 1927. For detailed information on Everdur, write for Publications E-11 and E-6.

60212

*Reg. U. S. Pat. Off.

ANACONDA

Everdur

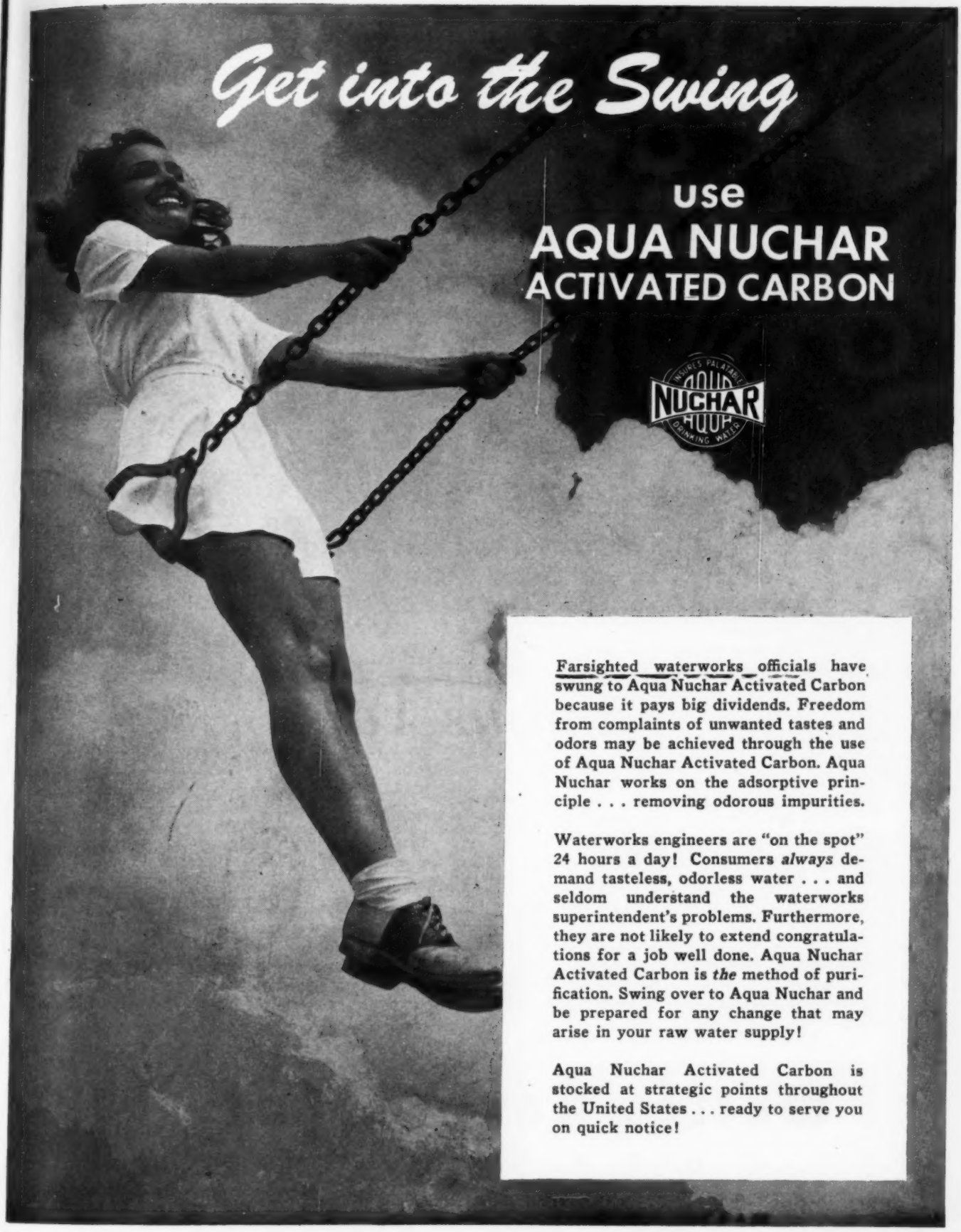
COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*



Farsighted waterworks officials have swung to Aqua Nuchar Activated Carbon because it pays big dividends. Freedom from complaints of unwanted tastes and odors may be achieved through the use of Aqua Nuchar Activated Carbon. Aqua Nuchar works on the adsorptive principle . . . removing odorous impurities.

Waterworks engineers are "on the spot" 24 hours a day! Consumers *always* demand tasteless, odorless water . . . and seldom understand the waterworks superintendent's problems. Furthermore, they are not likely to extend congratulations for a job well done. Aqua Nuchar Activated Carbon is *the* method of purification. Swing over to Aqua Nuchar and be prepared for any change that may arise in your raw water supply!

Aqua Nuchar Activated Carbon is stocked at strategic points throughout the United States . . . ready to serve you on quick notice!

INSURES PALATABLE NUCHAR DRINKING WATER

INDUSTRIAL CHEMICAL SALES

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Famous Facts

Prototype of the famous "Big Inch," the six-inch pipe line shown under construction was, in 1900, the longest continuous line in the United States. Running from Cairo, Texas to Bayonne, New Jersey, it was the greatest link in the system joining the oil fields of the Southwest with the refineries of the East.

By this time, Bitumastic Enamel — first developed in the 1850's as a protective coating for internal ship surfaces — had already established its outstanding reputation for giving maximum protection to underground pipe lines and metal structures.

Because of its high viscosity, strong adherence and resistance to soil stress, Bitumastic Enamel today gives assured protection to water works and sewer pipe lines in every type of corrosive soil and climate.

Another specialized coal-tar base coating, Bitumastic No. 50, gives long-lasting protection to sewage plant equipment and structures against the severe action of moisture, acid and alkali fumes.

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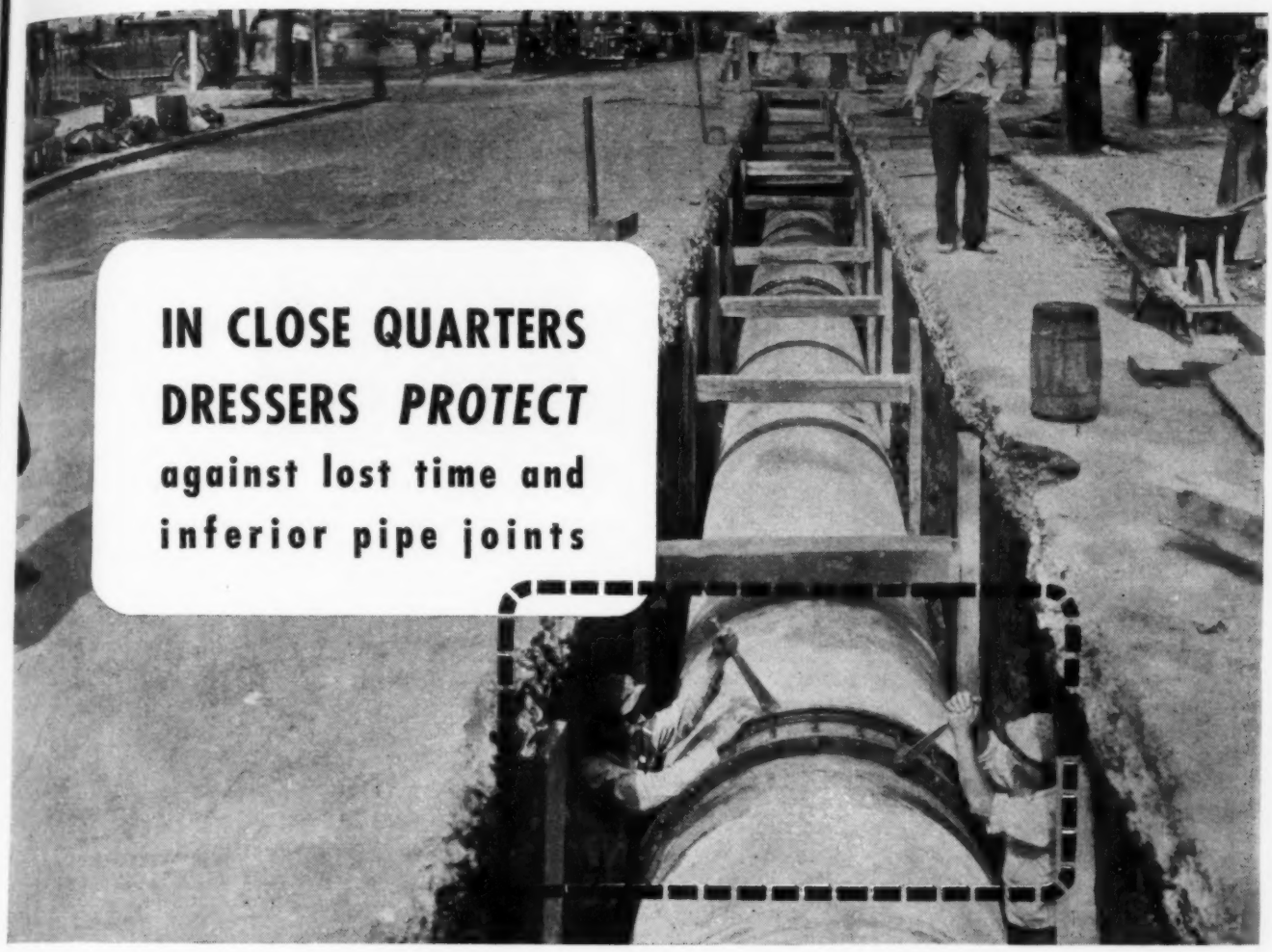
CORPORATION

WESTFIELD, NEW JERSEY

New York 4 • Philadelphia 8 • Cleveland 14 • Chicago 3 • Houston 2 • Tulsa 3
Miami 36 • San Francisco 10 • Los Angeles 1



IN CLOSE QUARTERS DRESSERS *PROTECT* against lost time and inferior pipe joints

In metropolitan areas, narrow ditches and cramped working spaces, due to traffic congestion and subsurface structures, often impede the rapid installation of pipe lines. This means loss of time and money.

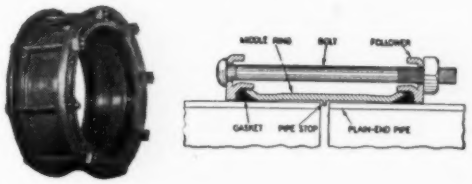
The use of Dresser Couplings speeds installation in city streets and, at the same time, assures a *uniform, permanently tight pipe joint.* Dressers' simplicity and ease of assembly allow any workman to join pipe quickly and efficiently under the most difficult conditions.

Avoid prolonged traffic tie-ups, expensive machinery breakdowns and delays due to inclement weather. Choose the coupling which can be assembled any time, anywhere, with uniform performance assured under all conditions.

Dresser *precision-made* couplings and repair products have long been held in the highest regard by engineers everywhere because of their permanent tightness, simplicity and over-all economy. Write today for further information.

* * *

DRESSER MANUFACTURING DIVISION, BRADFORD, PA.
Houston Office and Warehouse, 1121 Rothwell St., Sec. 16, Houston, Texas. In Canada, Dresser Manufacturing Co., Ltd., 60 Front St., West, Toronto, Ontario.



SIMPLE—SURE—PERMANENT

Very few parts . . . all factory built . . . easy to assemble. Style 38 Couplings are made for pipe from 3/8" to 60" and larger.

DRESSER COUPLINGS

ONE OF THE DRESSER INDUSTRIES

"Varec" THE GUARDIAN OF SEWAGE GAS CONTROL

THE PACE SETTER SINCE 1928

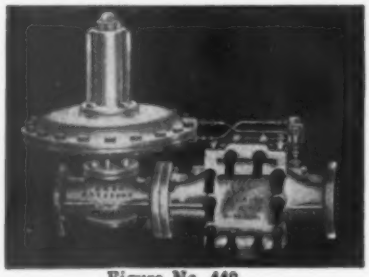


Figure No. 440

Sizes	2"	2½"	3"	4"	6"
Sh. wt.	125	140	160	200	260

← THE NEW "VAREC" *Approved* PRESSURE RELIEF AND FLAME TRAP ASSEMBLY

Unit consists of Diaphragm-operated Regulator, Flame Trap, and Thermal Shutoff Valve. Maintains a predetermined back pressure, passing surplus gas to Burner. Stops flame propagation. Patented telescopic flame trap element simplifies inspection and maintenance Listed by the Underwriters' Laboratories for vent lines in oil tanks.

Figure No. 58C

"VAREC" *Approved* PRESSURE RELIEF AND VACUUM BREAKER VALVE WITH ← FLAME ARRESTER

Installed on digesters and gas holder domes, it affords emergency Pressure and Vacuum Relief and prevents flame entrance from atmospheric disturbances. Equipped with extensible Flame Arresting element for easy inspection and maintenance. Pure aluminum. Non-corrosive. Listed by the Underwriters' Laboratories for Vent Lines in oil tanks. Sizes 2" to 10".

Sizes	2"	3"	4"	6"
Sh. wt.	70	105	160	225

"VAREC" *Approved* WASTE GAS BURNERS →

Installed wherever disposal of surplus gas is a problem. Unit has adjustable air intake in the venturi tube, pilot valve adjustable from outside. Long, heavy cast iron draft stack insures proper draft and complete combustion.

Sizes	2"	3"	4"
Sh. wt.	450	480	500

Figure No. 236

Figure No. 450

"VAREC" *Approved* FLAME TRAP ASSEMBLY

Flame Trap and Thermal Shutoff Valve. Unit self-contained, simple, foolproof. Installed in all gas lines supplying gas utilization equipment. No expensive fitting-up necessary. Arrests flame propagation. Easy inspection and maintenance. Aluminum and stainless steel. Non-corrosive. Flame Trap Element listed by Underwriters' Laboratories for vent lines in oil tanks.

Sizes.	2"	2½"	3"	4"	6"
Sh. wt. .	90	100	115	150	200

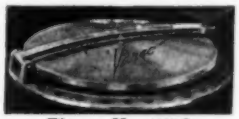


Figure No. 220A

"VAREC" *Approved* MANHOLE COVERS

Installed on digester and gas holder dome, affords quick and easy access. Has square, graphite-impregnated, fire proof gasket. Nonsparking. Gas-tight.

Sizes	18"	20"
Sh. wt.	100	110

Figure No. 51A

"VAREC" *Approved* FLAME CHECK

Acid resisting. Union type fitting. Positive flame stop for small lines. Has five 40-mesh fire screens. Easy inspection and maintenance.

Sizes	½"	¾"	1"
Sh. wt. . .	10	10	10

Figure No. 216A

"VAREC" *Approved* MANOMETERS

Single or Triple tube. Open or push-button control types. Accurate. Aluminum housing. Bronze fittings. Pyrex glass. Automatic—Fireproof—Safe. Sizes 6" to 36".

Sizes	9"	12"	15"
Sh. wt. .	16	18	20

Figure No. 387

"VAREC" *Approved* SENSITIVE PRESSURE (REDUCING) REGULATOR SINGLE PORT

Maintains upstream or downstream pressure to within 0.5" of water of pre-determined pressure. Positive Shutoff. Aluminum body. Throttling type inner valve. 18-8 stainless steel trim. Sizes 2" to 6".

Sizes . .	2"	2½"	3"	4"
Sh. wt.	110	115	140	175

Figure No. 211A

"VAREC" *Approved* BACK PRESSURE (REDUCING) CHECK VALVE

Installed in relatively low pressure gas lines. Prevents back-flow through meters. Non-chattering, non-pulsating, non-corrosive, non-sparking.

2"	3"	4"	6"
20	35	70	135

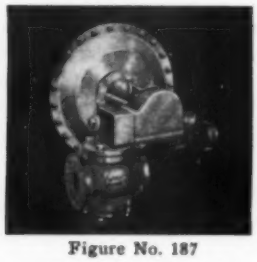


Figure No. 187

"VAREC" *Approved* SUPER SENSITIVE PRESSURE (REDUCING) REGULATOR DOUBLE PORT

Maintains upstream or downstream pressure to within 0.2" of water of pre-determined pressure. Standard working parts 18-8 stainless steel with synthetic rubber diaphragm. Non-corrosive. Sizes ½" to 10".

½"	2½"	3"	4"	6"
190	200	233	260	350

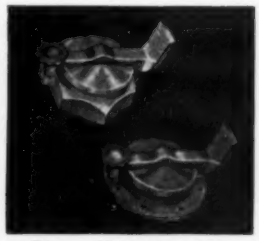


Figure Nos. 48 and 42A

"VAREC" *Approved* SAMPLING HATCH COVERS

For use on digester domes. Available in several combinations of materials. Non-corrosive, gas-tight, self-closing, spark-proof. Figure 42A Flanged and Figure 48 Screwed.

4"	6"	8"	10"
12	17	23	27

Figure No. 232D

"VAREC" *Approved* SEDIMENT TRAP AND CONDENSATE DRIP TRAP ASSEMBLY

Cast iron construction. 18-8 stainless steel working parts. Hand operated or automatic. Sizes 2"-2½"-3"-4".

THE VAPOR RECOVERY SYSTEMS COMPANY

COMPTON • CALIFORNIA • U.S.A. — Cable Address VAREC COMPTON (All Codes)

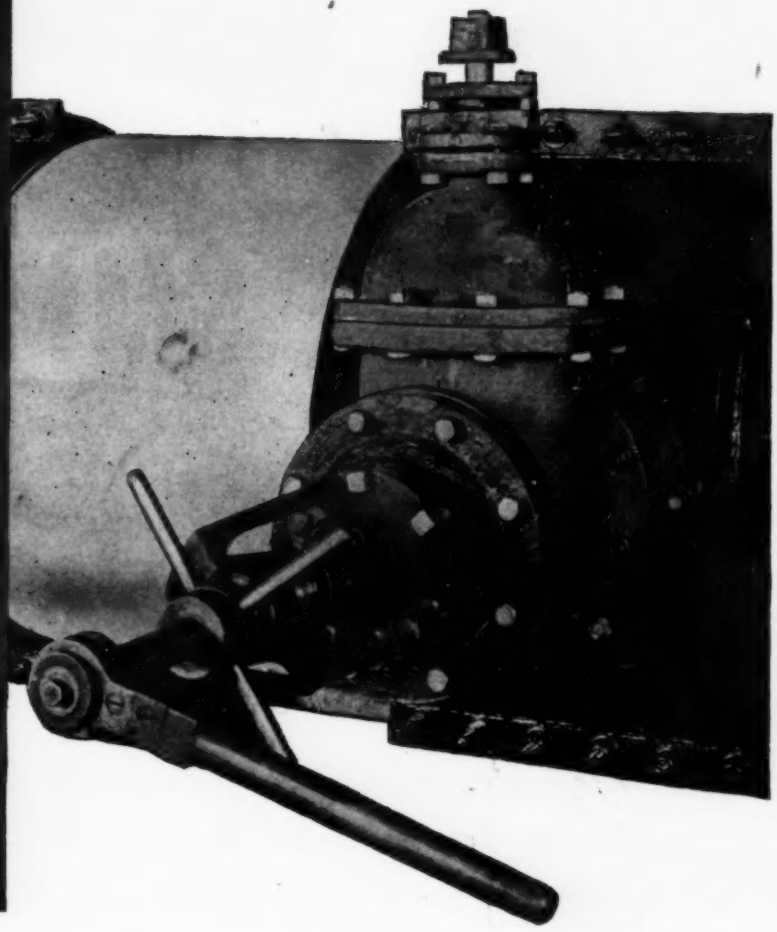
NEW YORK CITY — CHICAGO, ILL. — HOUSTON, TEX. — TULSA, OKLA.

Agencies Everywhere

Send for "Varec" Catalog S-3 for complete Sewage Gas Control Equipment.

ADVANTAGES OF PRESTRESSED CONCRETE CYLINDER PIPE • NO. 5

Easily and economically tapped...



● Prestressed Concrete Cylinder Pipe can be readily tapped under full operating pressure. This eliminates the necessity for dewatering the line when making connections not originally contemplated at the time of construction. The work can be done by regular maintenance crews with their own equipment.

Reducers, wyes, tees and elbows are made according to standard Lock Joint Pipe design ... and constructed to meet every type of field condition. Prestressed Concrete Cylinder Pipe may be somewhat new to you *now* ... but already hundreds of thousands of feet have been installed and additional hundreds of thousands of feet are under contract on major projects throughout the Western Hemisphere. In the meantime, let us help your engineers plan your next job and show you the advantages of specifying Prestressed Concrete Cylinder Pipe in sizes of 16" to 84"—and even larger—for high pressure pipelines.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY

Established 1905

P. O. BOX 269, EAST ORANGE, NEW JERSEY

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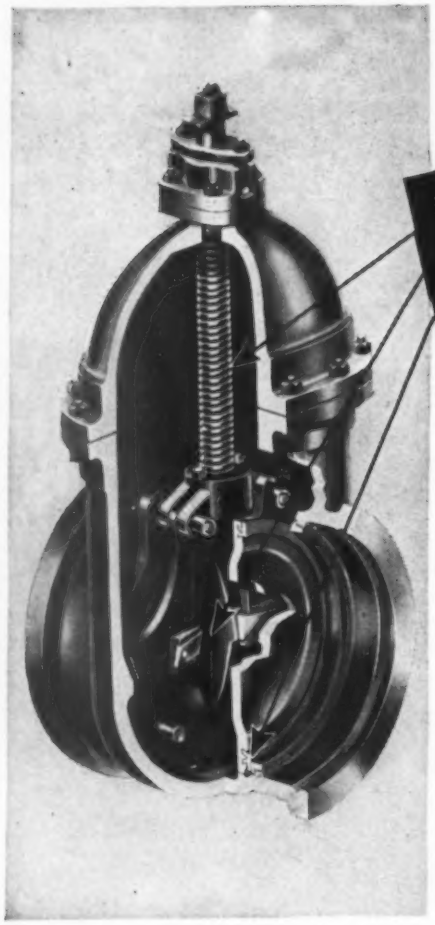
Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

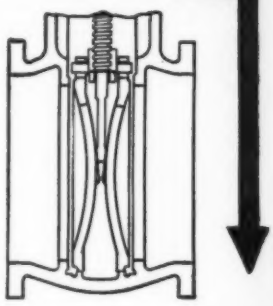
SCOPE OF SERVICES — *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*



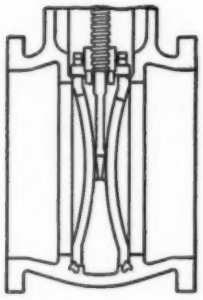
1. Continued turning of valve stem.
2. Brings wedges into action and expands the discs against their seats.
3. After disc travel ceases.

Why SMITH GATE VALVES DO NOT WEDGE PREMATURELY

All the Way DOWN



and then OUT



Because of its unique *side* wedging action, the discs of a Smith Gate Valve are not expanded laterally until *after* they have completed their travel and fully cover the ports. Termination of the discs' travel and further turning of the valve stem actuates the wedges and expands the discs. In opening, the action is reversed, the wedges are fully released before the discs commence to travel to an open position.

Smith Gate Valves are made in all types and sizes for manual, hydraulic cylinder, or motor operation and for low—medium—high pressure services.

18

FIRE HYDRANTS
GATE VALVES
CHECK VALVES
INSERTING VALVES
TAPPING SLEEVES AND VALVES
WATER SERVICE BRASS GOODS

THE A. P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

FLOOR STANDS
INDICATOR POSTS
TAPPING MACHINES
INSERTING MACHINES
PIPE CUTTING MACHINES
CORPORATION TAPPING MACHINES

Attendance goes up when swimmers find a "good" pool with clean water that "feels" right and won't irritate eyes and nose. Be sure your pool is a "good" pool . . . get Sanitation HTH, the dry, free-flowing chlorine-carrier that contains over 70% available chlorine. Sanitation HTH retains its strength . . . protects pool water and entire premises from germs and odors . . . prevents the formation of slippery, unsightly algae growth. And to control alkalinity get PH-Plus, the fused alkali in convenient cake form. *The Mathieson Alkali Works (Inc.), 60 East 42nd Street, New York 17, N. Y.*

THIS 6 POINT PLAN IS THE MODERN WAY TO KEEP A POOL SAFE AND SANITARY:

1. **Use HTH to keep pool water safe.**
2. **Use HTH to guard against athlete's foot.**
3. **Use HTH to keep pool surroundings (beaches, pavement) sanitary.**
4. **Use HTH for bleaching and sterilizing towels.**
5. **Use HTH for pool cleaning and algae control.**
6. **Use PH-Plus for alkalinity control.**

Sanitation HTH is available in cases of nine 5-lb. cans and in 100-lb. drums; PH-Plus in 100-lb. bags.

Mathieson
SANITATION HTH

Sanitation HTH . . . Chlorine Dioxide . . . PH-Plus (Fused Alkali) . . . Caustic Soda . . . Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua . . . Dry Ice . . . Carbonic Gas . . . Synthetic Salt Cake . . . Sodium Chlorite Products . . . Sodium Methylate

WRITE FOR FREE 48-PAGE BOOKLET "KEEPING THE POOL SAFE AND SANITARY"

A LABORATORY RECORD

Proves again that the

SIMPLEX VENTURI TUBE

is the most accurate and dependable primary device

Actual weighed water ratings of 28 SIMPLEX Standard Form VENTURI TUBES for the measurement of air, show an arithmetical average of 0.9837, or an average deviation from the 0.9840 coefficient calculated for the design of only 0.03%.

Examine this chart carefully. B-B is the value (.984) of the SIMPLEX Venturi Tube Coefficient as calculated for the particular design of tube. The short lines near B-B are taken from the flat part of the coefficient curves of the 28 numbered Venturi Tubes.

Note the remarkably slight variations shown by the records of the 28 Venturi Tubes tested.

24 tubes within 0.3% (±) of the 0.984 value.
1 tube within 0.7% (+).
2 tubes within 0.5% (—).
1 tube within 0.4% (+).

Here is actual proof of the unsurpassed accuracy and dependability of the SIMPLEX VENTURI TUBE. Here is graphic evidence of the 45 years of experience in research and manufacture that makes such SIMPLEX records possible.

Write for Bulletin 300, describing SIMPLEX MO METERS and VENTURI TUBES.

SIMPLEX VALVE AND METER CO.

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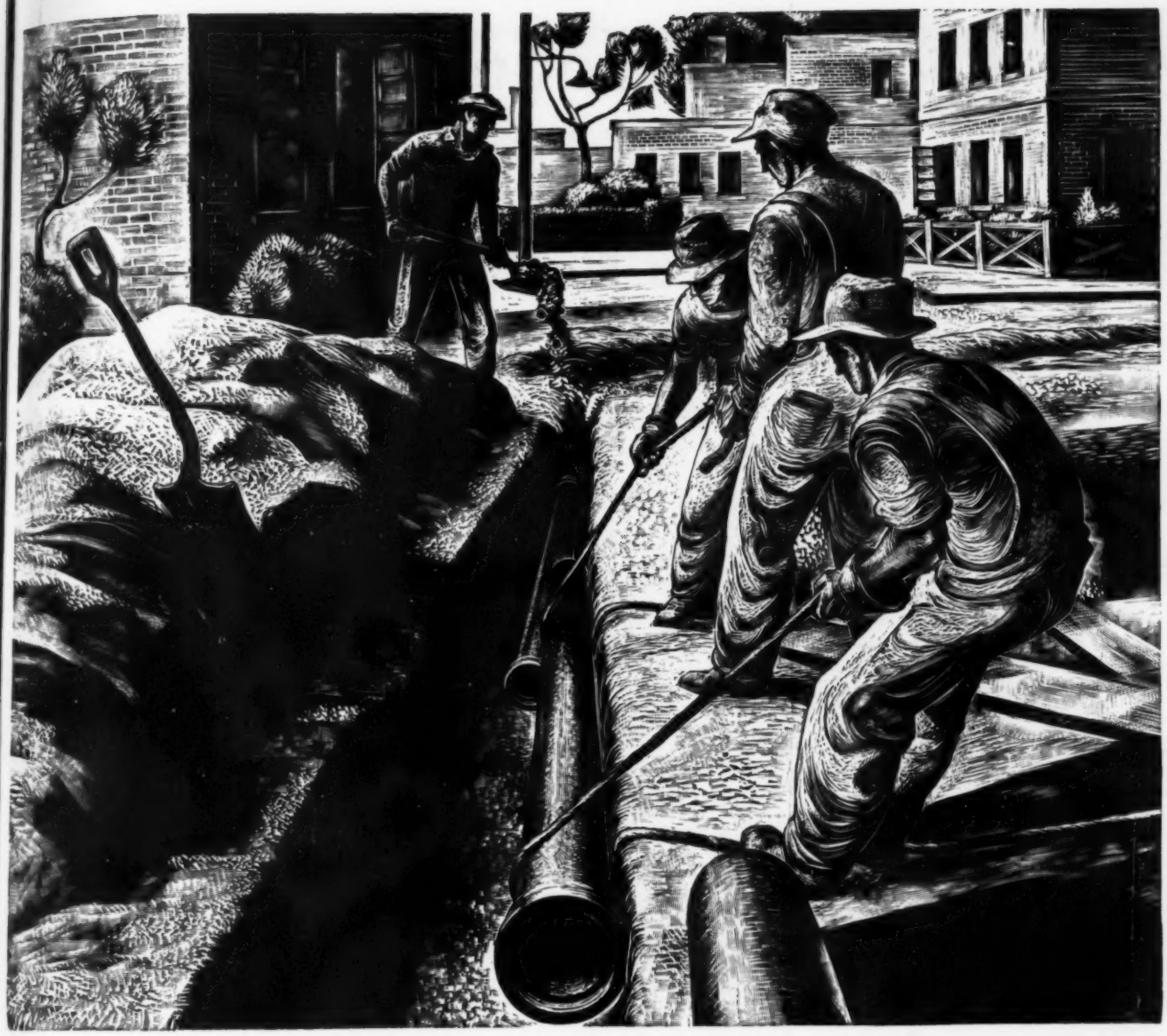

Original Woodcut by Lynd Ward

Housing on a tremendous scale must be constructed in the shortest time possible. We believe that an unhampered building industry can and will meet this challenge. Cast iron water, gas, and sewer mains will be extensively used to make these vital utility services available to these new homes. United States Pipe and Foundry Company is cooperating in this very important program to the fullest extent possible under present conditions.

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PIPE

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
Plants and Sales Offices throughout the U. S. A.

$2,000. INVESTMENT PAYS $29,565. PROFIT on a Flexible pipe cleaning job

WHAT WILL IT BE?

A Trickle or a Torrent for new Homes in your city?

THE above figures are the actual investment and profit from a Flexible watermain cleaning job in one city.* The lines were cleaned in 1940 for a total cost of $2,000. During the past five years a constant ph has been maintained. Actual savings in pumping costs amounted to $18,250 over the five-year period. With an increase of 365,000,000 gallons of water pumped each year or 1,825,000,000,000 gallons total at 3½¢ per cu. ft., the profit was increased $13,565 or a grand total of $31,565 less the $2,000 original investment.

Would your city be interested in an investment that pays 1400 per cent? Let Flexible figure the cost of cleaning your mains. Write or wire today for details.

*Name of city furnished upon request.

Flexible Service trucks complete with experienced crews and special Flexible-developed tools are strategically located in all sections of the U.S.A. to give pipe cleaning service quickly.

FLEXIBLE WILL CLEAN ANY PIPE FROM 2 TO 72 INCHES

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228 W. Broad St., Columbus 8, Ohio
1624 Marmon Place, Minneapolis 3, Minn.
P. O. Box 165, Atlanta.
P. O. Box 447, Lancaster, Texas
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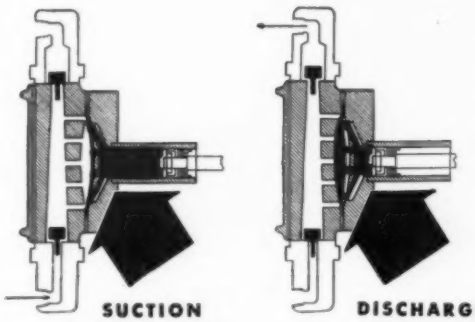
Flexible UNDERGROUND PIPE CLEANING CO.

9059 VENICE BOULEVARD • LOS ANGELES • CALIF.

THE *Diaphragm* DOES IT!



The Wilson Pulsafeeder operates on the positive displacement principle of the horizontal reciprocating pump. The exclusive Pulsafeeder feature, however, is an hydraulically-balanced diaphragm which isolates the piston and cylinder from the chemical solution being pumped. No contamination of water supply by the pump; no corrosive attack on pump parts by chemical solutions.

★ **ISOLATES CHEMICAL SOLUTION FROM OPERATING PARTS**

★ **NO PACKING GLANDS**

★ **BALANCED HYDRAULIC PRESSURE**

★ **POSITIVE DISPLACEMENT PISTON PRINCIPLE**

Wilson PULSAFEEDER

PATENTS APPLIED FOR

Long life of chemical feeding equipment and protected purity of your water supply is assured by the Wilson Pulsafeeder, the *balanced-diaphragm* Hypochlorinator and chemical feeder. Its rate of flow is continuously adjustable *while in operation.* Meter-controlled model maintains exactly proportioned feeding regardless of rate of water consumption. Sealed lubrication—all moving parts, except the motor, running in oil. Write for new illustrated description and specifications. *Process Equipment Division, Lapp Insulator Co., Inc., 120 Maple St., LeRoy, N. Y.*

Lapp

For Arlington County, Virginia...

This modern Tubular Column Tower, Toroidal Bottom, Elevated Steel Tank, 500,000 Gallons in Capacity

by PITTSBURGH · DES MOINES

BUILDERS OF DEPENDABLE ELEVATED STEEL TANKS SINCE 1897

The handsome appearance of this new Pittsburgh-Des Moines Elevated Steel Tank design is the result of sound engineering for better water storage.

60'0" in diameter, with a head range of only 24'8", the tank's 500,000-gallon water capacity is elevated on a tower 81'0" high.

Let us consult on your particular storage problem!

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NEW YORK, ROOM 915, 270 BROADWAY · CHICAGO, 1216 FIRST NATIONAL BANK BUILDING

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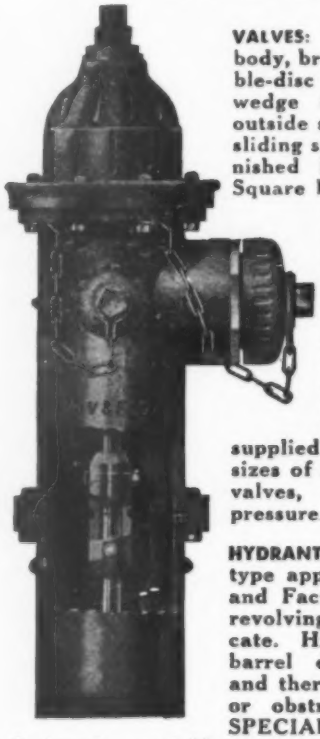
CAST IRON PIPE
SERVES FOR CENTURIES

Dependable!
Rugged!

VALVES
HYDRANTS



VALVES: A.W.W.A. type, iron body, bronze mounted with double-disc parallel seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship.

Hydraulically Operated: For remote control of operation and for quicker, easier opening or closing. Can be supplied in any of the standard sizes of M & H A.W.W.A. gate valves, either high or low pressure.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

Write for Catalog No. 34

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FIRE HYDRANTS	SHEAR GATES
GATE VALVES	MUD VALVES
TAPPING VALVES	VALVE BOXES
WALL CASTINGS	FLAP VALVES
SPECIAL CASTINGS	SLUDGE SHOES
TAPPING SLEEVES	FLANGE AND FLARE FITTINGS
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M & H VALVE
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To keep the water your community drinks worthy of that tribute, means you have to keep continuous vigilance over its treatment. How well water-works officials have done that job is evidenced by the remarkable decline in the typhoid rate and other illnesses from water borne bacteria in the United States.

Hooker Chlorine, at the right hand of water works officials for many years, is also upholding a record of its own . . . that of consistently uniform, high quality, to make your work easier. Hooker's Technical Staff is also at your service in helping you solve any problems involving the handling of Chlorine or any of the other Hooker Chemicals.

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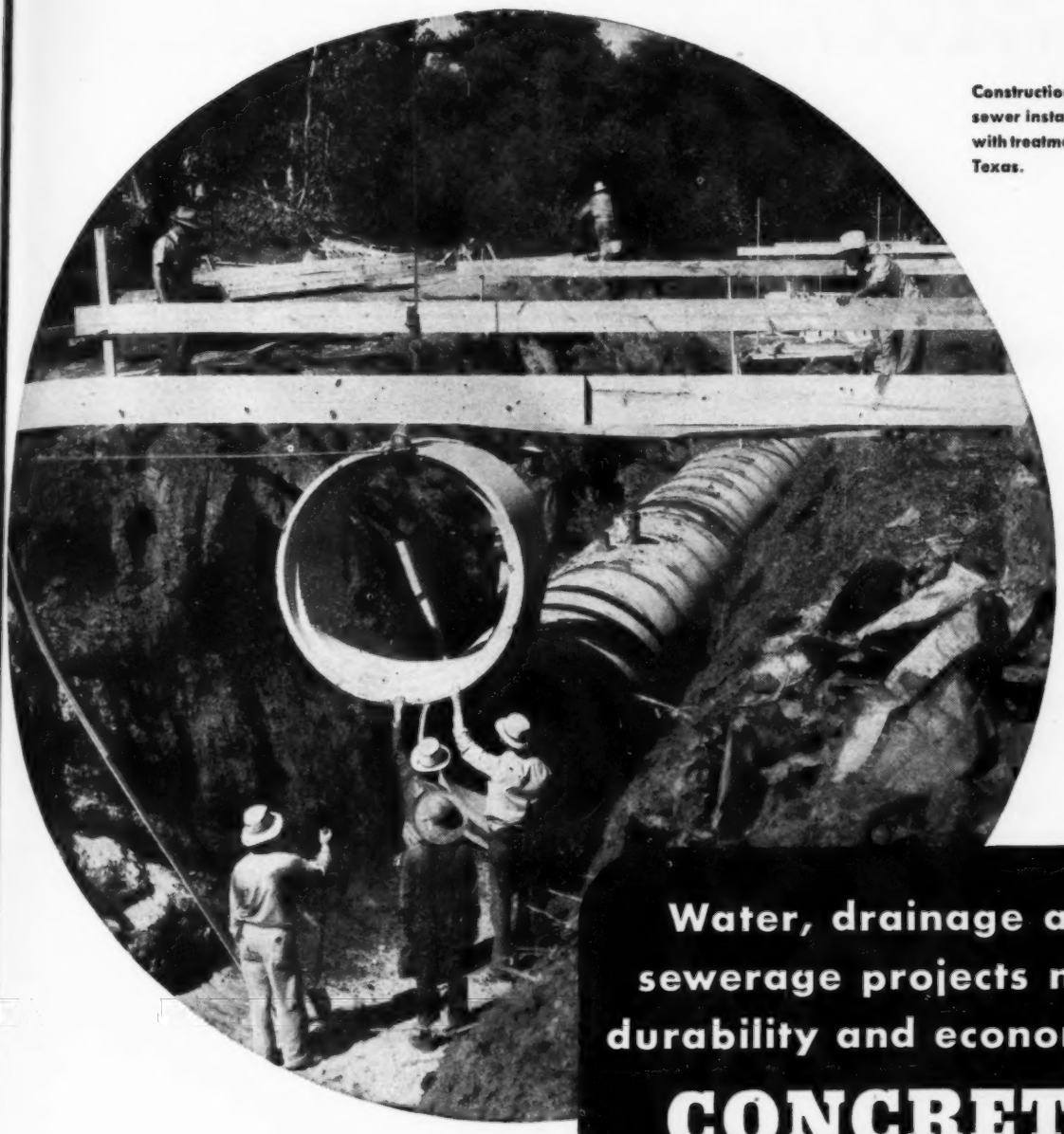

Construction view of concrete sewer installation connecting with treatment plant in Dallas, Texas.

Water, drainage and sewerage projects need durability and economy of

CONCRETE PIPE

THE strength and durability of concrete pipe for sewerage, drainage and water lines has been proved on a vast scale with installations which have served half a century or more.

Concrete pipe meets all the requirements of moderate first cost, structural strength and soundness, minimum infiltration and leakage, and maximum hydraulic capacity.

These advantages mean that concrete pipe installations give many years of service at low maintenance expense, resulting in *low annual cost*—the true measure of economy in pipe lines.

PORTLAND CEMENT ASSOCIATION

Dep't. 7-29, 33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

EXAMINE THE EVIDENCE

SHOULD WE PURCHASE A %PROPORTIONEERS% HYPOCHLORINATOR?

QUESTION	ANSWER
IS THE ORIGINAL INVESTMENT COST LOWER? *(including interest and depreciation)* . . .	**YES:** *%PROPORTIONEERS% Hypochlorinators are lower in cost; they are easily installed and give years of service.*
IS THE ANNUAL OPERATING COST LESS? *(including chemical cost and repairs)*	**YES:** *The accuracy of %PROPORTIONEERS% Chem-O-Feeders prevents waste and minimizes chemical cost. Repairs are negligible.*
IS OPERATING PERSONNEL READILY AVAILABLE?	**YES:** *%PROPORTIONEERS% equipment does not require a skilled operator . . . hypochlorination has none of the hazards of lethal chlorine.*
IS THE METHOD SIMPLE AND DEPENDABLE?	**YES:** *Hypochlorination with %PROPORTIONEERS% equipment is safe, simple and reliable. Over 20,000 %PROPORTIONEERS% have been sold.*
IS SERVICE READILY AVAILABLE AND LOW IN COST?	**YES:** *%PROPORTIONEERS% has a nationwide organization ready at all times to give service. Parts are inexpensive and fully interchangeable.*

IT'S ELEMENTARY, MY DEAR WATER WORKS SUPERINTENDENT!

Whether your water supply is pumped or gravity flow — high or low pressure — %Proportioneers% makes a hypochlorinator to meet your needs exactly. Operation may be constant rate, flow responsive or time responsive as desired. Weigh the evidence: on every count you'll find %Proportioneers% chemical feeding equipment best meets *your* requirements . . . and at a reasonable price!

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In this issue is the first of a series of articles which discusses "Hydraulics" in terms designed to be readily understandable to the practical water works operator and others who have never had the benefit of a college course in the important science of hydraulics. Other articles in the series will follow as rapidly as produced by the well qualified teacher of "Hydraulics."—

ROBERT W. ANGUS, M. E.
Professor Emeritus, Univ. of Toronto.

"Elementary Mathematics"

Is likewise being covered in a series of articles, the third in the series being in this issue. The fourth of this valuable series will appear in our August issue with still others to follow. These lectures designed especially for water and sewage plant operators are the contribution of—

DR. WARREN K. EGLOF,
Prof. of Chemical Engineering, Niagara Univ., N. Y.

"A Novel Sewer and Water Main Cleaning Unit"

Has been perfected by N. M. Redmond, Supt. of Sewer and Water Main Maintenance, for the Sewerage & Water Board of New Orleans. Having seen this unit in operation, the contributor of the article describing and illustrating the ingenious Norcan Water Main and Sewer Cleaner, who has many years been connected with sewer construction and maintenance, has this to say about the New Orleans cleaner. "To my thinking this is the most effective thing of its kind that I have yet seen." This keen observing expert is—

MORRIS W. LOVING,
Concrete Technologist and Consultant, Chicago.

"Some Notes on Water Quality and Corrosion"

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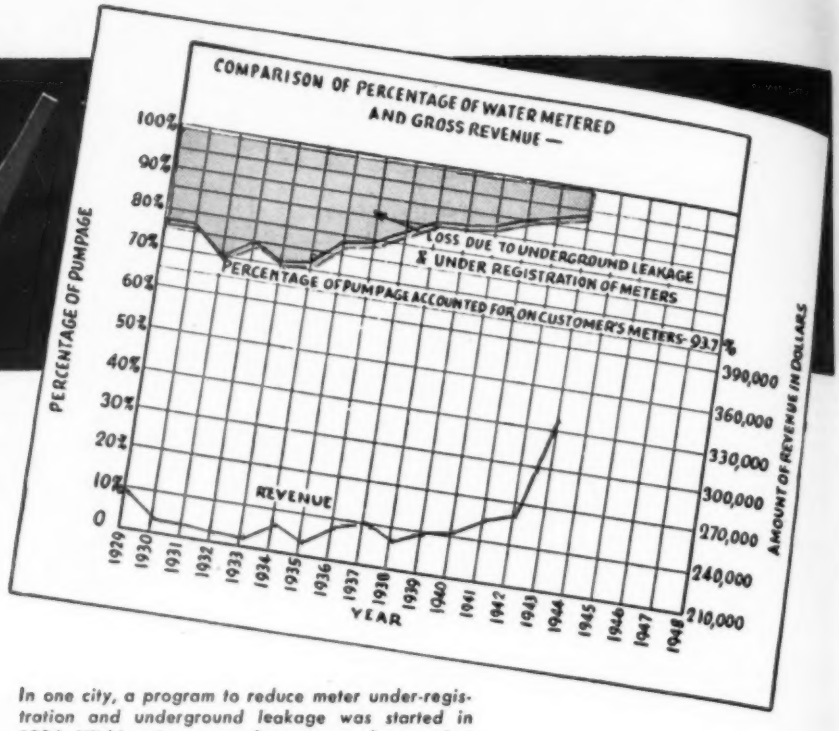

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WATER & SEWAGE WORKS

VOL. 93, No. 7 JULY, 1946

A Gillette Publication

THE WATER SUPPLY IN FRANKFURT, GERMANY

As Found Upon Occupation by U. S. Forces and Thereafter

By K. S. WATSON*
Chemical Engineer
WEST VIRGINIA WATER COMMISSION
CHARLESTON, W. VA.

THE city of Frankfurt (on the Main River) was the home of 240,000 people when it was occupied by the American Army late in March, 1945, and it was soon designated as the location for the Supreme Headquarters Allied Expeditionary Forces and the many military units supporting this high headquarters. When the writer reported from an Engineer Combat Battalion early in May, 1945, as Trade and Industry officer for the Military Government Detachment of the European Civil Affairs Division responsible for governing Frankfurt, he was assigned the task of making a survey to determine whether the city water was safe for the civilian and military personnel soon to be located in the city.

This highly industrialized city, largest in the American Occupational Zone of Germany, had a pre-war population of 600,000 and was known for the manufacture of chemicals, cars, machine parts, and typewriters before the war, and war materials during the combat phase. It was thus the target for many allied bombing raids. So effective was this aerial warfare that only 14 per cent of the buildings were undamaged, with the exception of windows, and 34 per cent were seriously damaged or completely destroyed. The city was taken by

The Author and Staff Car.

American ground force action, but the damage inflicted by our ground troops was negligible compared to the bomb damage.

Ownership and Operation Of Water Supply

The water system in Frankfurt is a municipal-owned utility. It is operated under the supervision of the Public Works Department of the city government which also operates the sewage and gas systems and maintains the streets and parks of the city. In the Public Works Department, the water and sewage systems have always operated under the same sub-department head. This position was held, oddly enough, at the time of occupation by a lawyer who had been in the job for many years. Although the field was somewhat foreign to his educational background, he was well-qualified in the field of water supply and had made two trips to the states to study American techniques. When the aggressive program of denazification was started he was removed from office as a result of his party activities during the war. The water and sewage sections were headed by technical men working under this sub-department supervisor.

Sources and Treatment

The water supply of Frankfurt originates in wells and springs situated in ten separate areas around the city. Table I lists the sources and their types, and the number of springs or wells contributing to each. At the Spessart Mountain source, the water from the concrete-enclosed Springs is collected in a covered concrete reservoir and piped by gravity to the city reservoir. The water from the Vogelsberg springs is collected behind an impounding dam and piped by gravity to the city. The wells, which are one hundred feet apart and average fifty-five feet in depth, had been dug by hand or machinery. The wells contributing to any one source are located on both sides of and connected to a common header wnich delivers the water to a pump station for transmission into the city. The method used is similar to our system of connecting a gang of wells in this country. In every installation the pumps are located in pump pits twenty to thirty feet below the ground surface. In most cases the

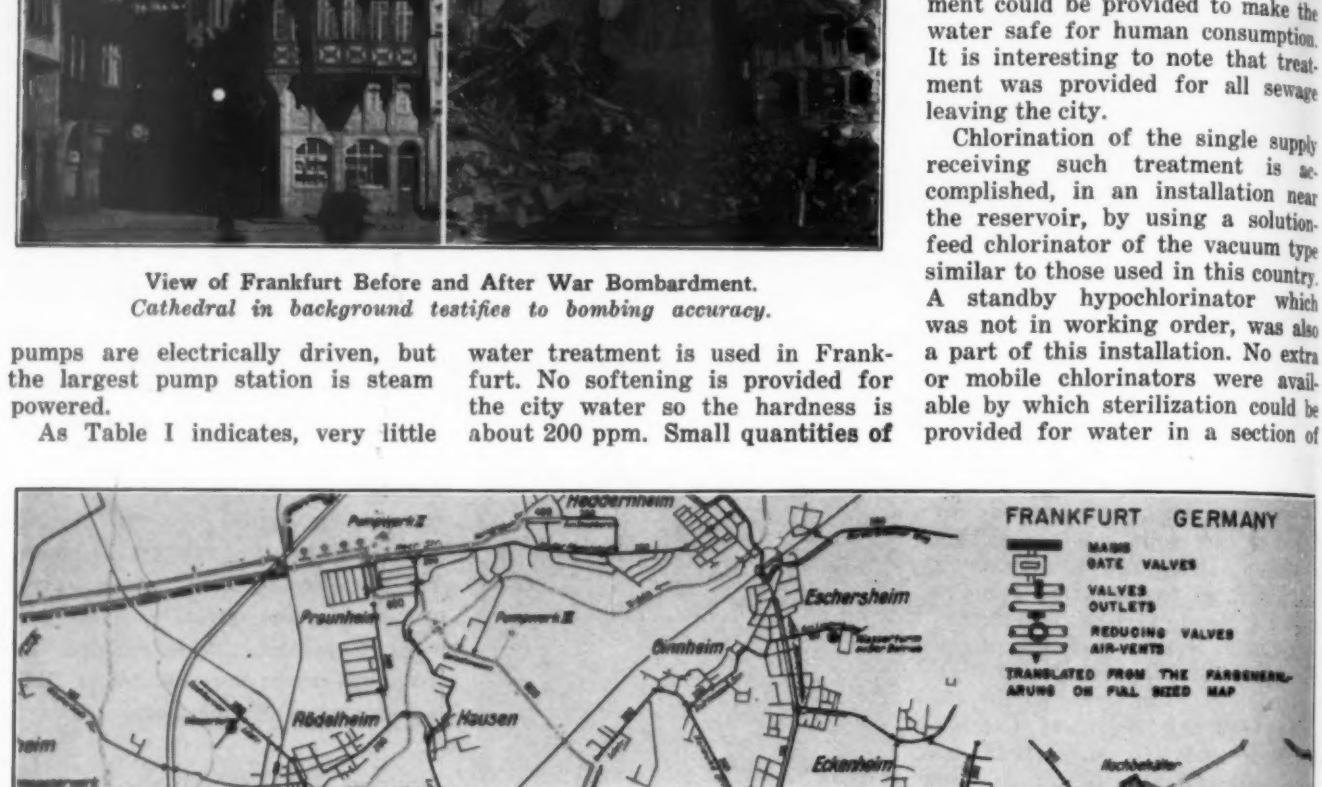
*Formerly Trade and Industry officer, Mil. Govt. Detachment, Frankfurt, A.M., Germany.

View of Frankfurt Before and After War Bombardment.
Cathedral in background testifies to bombing accuracy.

pumps are electrically driven, but the largest pump station is steam powered.

As Table I indicates, very little water treatment is used in Frankfurt. No softening is provided for the city water so the hardness is about 200 ppm. Small quantities of iron are present in the water. The doctrine of the water supply personnel seemed to be that of obtaining water from an unquestionable source, properly protecting the source and the water from source to the consumer. When the technical personnel were asked about the possibility of installing a treatment plant and using water from the Main River, which flows through the city, doubt was expressed that sufficient treatment could be provided to make the water safe for human consumption. It is interesting to note that treatment was provided for all sewage leaving the city.

Chlorination of the single supply receiving such treatment is accomplished, in an installation near the reservoir, by using a solution-feed chlorinator of the vacuum type similar to those used in this country. A standby hypochlorinator which was not in working order, was also a part of this installation. No extra or mobile chlorinators were available by which sterilization could be provided for water in a section of



Map of Portion of Water Distribution System for Frankfurt.
Reproduced from an original effective eight-color German map which covered the entire system.

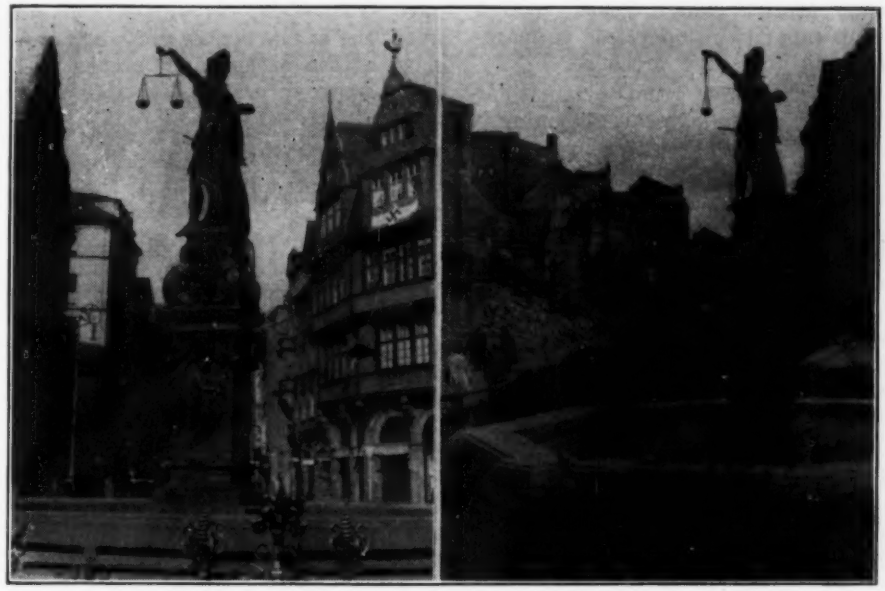
the distribution system as a safeguard against pollution resulting from bomb damage.

The marble filters (contact beds), for reducing the aggressivity of the water by removal of free CO_2, (Table I) are somewhat similar to our pressure filters except that the depth of filtering media is considerably greater and no provisions for backwashing are included. Every four to six months, about a foot of make-up marble is added to the filters. The water flows through one of the filter installations by gravity and is pumped through the other. As indicated in Table I water from the largest source is pumped through aeration nozzles to remove the iron.

The hydrate of lime and magnesium feeders for treating the Forsthaus and Hinkelstein supplies are electrically motivated, vibrator type, dry-feed machines.

Four Pressure Zones

The sizes of the city water mains are shown in millimeters on the accompanying map. The mains were mostly cast iron until the bombing started but thereafter considerable steel pipe was used for repair work. Large quantities of both steel and cast iron pipe were available in Frankfurt at the end of the war. There are four separate pressure zones in the distribution system, each covering a section between certain elevations. These zones are connected together stepwise so that any excess of water becoming available in one of the systems can be drained down to the next zone.



Another View of Frankfurt Before and After Bombardment.
Something happened to the scales of Justice.

As is indicated on the map, there are four principal reservoirs in the system with a combined capacity of 15 million U. S. gallons. However, the capacity of the large reservoir north of the river was not all effective, since half of it had been so badly damaged that it could not be used. The three remaining small reservoirs have a total capacity of 159,000 gallons. The reservoirs are of covered, sectional, concrete construction located at elevated points in the city. These concrete basins had been turfed over and the only indication from the ground surface of the existence of a reservoir is the concrete control and pump building standing above the ground near the center of the reservoir.

The Heiligenstock reservoir north of the river has a mean water elevation of 597 feet, and supplies the two higher zones in that part of the city. The large northern reservoir has a mean water elevation of 472 feet and supplies water to the two valley distribution systems in the north of the city. The southern reservoir with a mean water elevation of 482 feet supplies all three zones south of the river. Pressure is maintained in the high zone from this reservoir by an automatic electric

TABLE I

Water Sources for City of Frankfurt, Germany

Sources Location	Type	Treatment	How Pumped	Enters Water System	Maximum Production (Millions U. S. Gals. Per Day)
1. Inheiden Near Town of Hungen, (60 km. north of city)	Wells	None	Central electric pumping station	Heiligenstock res...	5.3
2. Spessart Mountains (70 km. East of city)	Springs (15)	Passes through marble filter to remove carbonic acid	Gravity	Northern reservoir..	2.1
3. Vogelsberg (70 km. East of city)	Springs (30)	Chlorination	Gravity	Northern reservoir..	2.1
4. Forsthaus (South of city)	Wells (16)	Hydrate of magnesium added to remove carbonic acid	Central electric pumping station standby Diesel	Southern reservoir..	1.3
5. Goldstein (South of city)	Wells (26)	Passes through marble filter to remove carbonic acid	Central electric pumping station standby Diesel	Southern reservoir..	5.3
6. Hinkelstein (South of city)	Wells (30)	Hydrate of lime added to remove carbonic acid	Central electric pumping station standby Diesel	Southern reservoir..	5.3
7. Between Hattersheim and Eddersheim (West of city)	Wells (30)	Aeration to remove iron	Central steam pumping station standby electric pump	Northern and Southern reservoir	10.6
8. Hattersheim (West of city)	Wells (3)	None	Central electric pumping station	Northern and Southern reservoir.....	4.0
9. Praunheim II (North of city)	Wells (5)	None	Central electric pumping station	Northern reservoir.	2.6
10. Praunheim III (North of city)	Wells (3)	None	Central electric pumping station	Northern reservoir.	1.3
				Total	39.9

pump station which keeps enough pump capacity in operation to maintain the necessary pressure.

In Frankfurt great precautions had been taken to prevent contamination of drinking water by sewage by burying the sewage system from three to twelve feet below the water mains. The difference in elevation of the two systems no doubt partly accounts for the absence of coliform organisms in the city water. The depth of the sewage system to a marked degree also retarded the repair work necessary to put this system back into operation.

Prior to the war Frankfurt had a centrally-located electrically operated control panel to provide finger-tip control for the water system. All the pump stations could be placed in operation and closed down from the control panel. The flow of water in the city could be altered as desired from the control panel by the use of remote controlled electrically operated gate valves throughout the system. A warning system, which called attention to operating difficulties at the installations that were operated without continuous manual supervision, was also incorporated into the panel.

War Damage

Since the sources of water and the major pump stations are located near the city limits or outside the city, they were not seriously damaged by war activities. A building located in the business district of the city, which housed the water laboratory the operating panel and office space for some of the technical and maintenance personnel, was destroyed. Half of the storage capacity of the large northern reservoirs was badly damaged. The bombing of the city created hundreds of breaks in the major mains of the distribution system and thousands of breaks in the minor lines. The water personnel kept at the endless job of attempting to repair the system during the war, but they continually lost ground in attempting to keep abreast of the damage being inflicted. By the end of the war, four of the five major river crossings had been broken. A syphon crossing in the West end of the city (not covered by map shown) was the only connecting link in the distribution system between the portions of the city north and south of the river. The other four crossings had been made on bridges and when these structures were blown, mostly by Nazi party fanatics, during the last disorganized days of the German Wehrmacht, the system was almost severed in half. By early October, 1945, one of the bridge crossings and most of the major main breaks had been repaired.

Water Consumption

As indicated in Table I, the combined water sources for the city have a capacity of about 40 million U. S. gallons of water per day. During the summer of 1945, an average of about 27 million gallons of water was pumped into the city distribution system daily. In May, 1945, the leakage through breaks was estimated to be 55 per cent of the water entering the system. In October the pumpage was about the same and the leakage was estimated to be 30 per cent of the incoming water. Since the population of the city was about 250,000 in May, the average water consumption including leakage, and industrial water, was about 108 gallons per person per day. The population increased to 330,000 by October, so the average water consumption (including leakage) was 82 gallons per person per day at that time. Much of the water being used by industry was river water.

In 1940 the water consumption for the city was estimated by water supply personnel to be 26 million gallons per day. This would make the average consumption, including industrial uses, 43 U. S. gallons per person per day. Records covering water plant operation before the war were meager, but it was estimated that about 90 per cent of all consumer services were metered. The policy of metering was being followed after the war, and the program of checking and rehabilitating meters was proceeding as rapidly as possible. Consumers were being billed and paying for water service all during the war, and this procedure was continued into the post-war period.

Bacteriological Technique And Control

The bacteriological laboratory which was a part of the water system in normal times, ran about fifteen water samples daily taken from the sources and at different points throughout the distribution system. The hygienic laboratory of the City Health Department, which supplied the necessary media to the water system laboratory for bacteriological control, analyzed an average of five samples daily on water samples collected by water plant personnel. During the post-war period the city continued running the same number of samples, but due to the destruction of the water plant laboratory and much of the equipment, only a small number of samples were analyzed by that laboratory.

An inspection of most of the bacteriological results completed by the city between May 1, and October 1, 1945, indicated that no coliform positive samples had been found. In a series of about forty samples, collected during the same period and analyzed by a U. S. Army General Hospital, the absence of coliform organisms in the system was confirmed. The Vogelsberg Springs (Table I) which was the only supply being chlorinated, had a consistent bacteria count between 100 and 500, and this was quite high in comparison with the other sources of water. The German bacteriologists seemed to place more credence in plate count as a criterion for determining bacteriological water quality than is generally given this determination in the states. The bacteriological condition of the water and the resulting low incidence of diseases of water origin were rather amazing, considering the terrific bombardment that the city had taken during the war.

The bacteriological analyses of water in Frankfurt consisted of:

1. Running a gelatin plate count on a 1 ml. portion of sample at 22° and counting the saprophytic organisms.

2. Running an agar plate count on a 1 ml. portion of sample at 37° and counting the "thermophile organisms."*

3. Adding 1.0, 25 and sometimes 100 ml. portions of water to tubes containing trypsinbullion and incubating at 37°C for 24 and 48 hours. All portions of water are tested after incubation with p-dimethylaminobenzaldehide reagent to determine whether or not indol has been produced. Plates of endo-agar are streaked from indol-positive tubes or flasks of trypsinbullion, "non-succulent flat colonies with gleaming of fuchsin which are typical for common colibacteria will be vaccinated on dextro (grape sugar) feeding bullion."* These tubes of dextrose broth are then incubated at 46°C (for at least 24 hours presumably); development of gas in this medium at the elevated temperature is interpreted as confirmation of the presence of Esch. coli from warm blooded animals. This is roughly comparable to the use of Eijkman's medium in this country except that it has been generally accepted that the use of lactose rather than dextrose is preferable in this medium.

*Terminology used by the bacteriologist of the Frankfurt City Hygienic Laboratory.

HYDRAULICS FOR THE PRACTICAL WATER WORKS MAN

The First of a Series of Articles

By ROBERT W. ANGUS, M.E.
Consulting Engineer
TORONTO, CANADA

Professor Emeritus of Mechanical Engineering, University of Toronto

The Author

THE science of hydraulics, which deals with the flow of fluids in pipes, channels, pumps, turbines and other machines and devices, has been looked upon by many operators of waterworks plants and by engineers without college training as something formidable, generally because they have felt that its principles and ideas offered mathematical difficulties beyond their grasp. They have thus denied themselves the use of a tool which would enable them to solve many everyday problems arising in their work.

Actually the subject presents few theoretical difficulties, and anyone knowing the algebra of the first year in high school would have no difficulty with fairly advanced work in hydraulics, and a man with a good knowledge of arithmetic should be able to solve most problems that arise. The usual trouble, where it exists, is not with the technical side but with the application of the principles involved, and in this respect the practical engineer has many advantages, for he can visualize the conditions as they arise; without his background a full understanding of this subject is not very easy.

Hydraulics is used in solving problems on flow of all fluids whether they are liquids (incompressible) or gases such as air and chimney gases, or vapors such as steam, which are compressible, but at present, consideration will be limited to liquids, of which the most common is water. In the daily routine of water and sewage works operations the flow of oils and miscellaneous liquids forms a very small part and, in any event, nearly all such problems may be solved by the same methods as apply to water.

In this present series of articles the author will try to lay down in simplest form the basic principles underlying the flow of water and will show their application in a number of practical problems.

One Important General Principle

In establishing the one general principle which occurs perpetually in this work, the usual practice is to proceed by considering the power carried by the water in its passage along a pipe, canal or machine. Care must, of course, be taken with the units employed, as much confusion and error results from neglect in this respect. Lengths are measured in feet, areas in square feet, and discharges in United States gallons per minute. Where the Imperial gallon is used, as in Canada and Great Britain, it is very easy to get the equivalent in United States gallons by remembering that one Imperial gallon has the same volume as 1.2 United States gallons. The United States gallon of cold water at ordinary temperature weighs 8.33 lbs., therefore the Imperial gallon weighs $8.33 \times 1.2 = 10$ lbs., and 1 cubic foot of water under the same conditions weighs 62.4 lbs. These figures occur very often and must be remembered or noted for easy reference.

Practically all hydraulic problems involve the velocity of water in the pipe or channel, and indeed speed is one of the most important considerations in this and almost every other science. Speed determines the type of pumping engines used, the general shape of locomotives and railroad cars, the choice between centrifugal and reciprocating pumps, etc. High speed machines are usually relatively small and compact, just as pipes carrying water at high velocity are small, but with the high speed, wear and losses of power occur and, therefore, convenience and size have to be balanced over against the disadvantages.

In waterworks piping particularly, fairly low velocities are common, because the pipes are long and the losses must be reduced, and also because the cost of laying such pipes is high relative to the cost of the pipes, so that it is best to have them on the large side. Velocities around 4 or 5 ft. per sec. are not uncommon, and during fires they may go much higher, but velocities below those named are not used except with intakes and such work where loss must be kept to a minimum, or else where a pipe supplies a growing district. For convenient reference, Table I has been made, which gives velocities in pipes up to 12 in. diameter for different flows, and this table may be easily used for larger pipes and other discharges. For example, although a 20 in. pipe has a diameter only twice that of a 10 in., the area is four times as great. Therefore, the velocity in the 20 in. pipe for a given discharge is only one-quarter that in the 10 in. for the same discharge.

TABLE I
Velocities in Pipes

Pipe size (in.)	Actual diam. (in.)	Area (sq. ft.)	Velocity ft. per sec. for 100 U. S. gal. per min.	Pipe size (in.)	Area (sq. ft.)	Velocity ft. per sec. for 1,000 U. S. gal. per min.
1 in gas	1.049	.00600	37.1	4	.0873	25.50
1¼	1.25	.00852	26.2	6	.1963	11.33
1¼ in gas	1.380	.00958	23.3	8	.349	6.37
1½	1.50	.01227	18.2	10	.545	4.07
1½ in gas	1.61	.01414	15.8	12	.785	2.83
2 in gas	2.067	.0233	9.6			
3 in gas	3.068	.0513	4.33			

1000 U. S. gallons per minute = 1.44 million gallons per 24 hours. One cubic foot per second (1 c. f. s.) = 450 U. S. gallons per minute (450 g. p. m.)

In setting up the basic laws and relationships that must be employed, the usual and simplest method is to consider the power carried in the water. Power in flowing fluids exists in several forms; for example, where a pump delivers water from a well to a reservoir it has lifted the water from a low elevation to a higher

one, and for that effect each pound of water had work done on it by the pump.

The difference in levels of the water surfaces is commonly called the "head" on the pump in feet, this head simply being the difference in elevation of each pound of water as it is pumped, that is, each pound of water has changed its "elevation head."

The power required to produce this change in elevation is the weight of water per minute multiplied by this change in elevation, or if the pump delivers G gallons per min., the power in ft. lbs. per min. will be 8.33 G times the change in elevation. Since there are 33,000 ft. lbs. per min. corresponding to a horsepower, the above pump would have to put 8.33 G times the change in elevation/33,000 H.P. into the water; naturally, the power on the pump shaft would exceed this by the losses in the pump and piping. To raise 1,200 gal. per min. a vertical distance of 200 ft. from well to reservoir level would require $8.33 \times 1{,}200 \times 200/33{,}000 = 60.6$ H.P. put into the water or a shaft horsepower perhaps over 80.

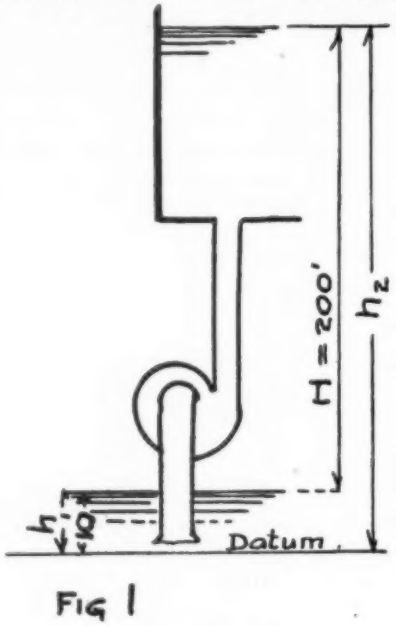
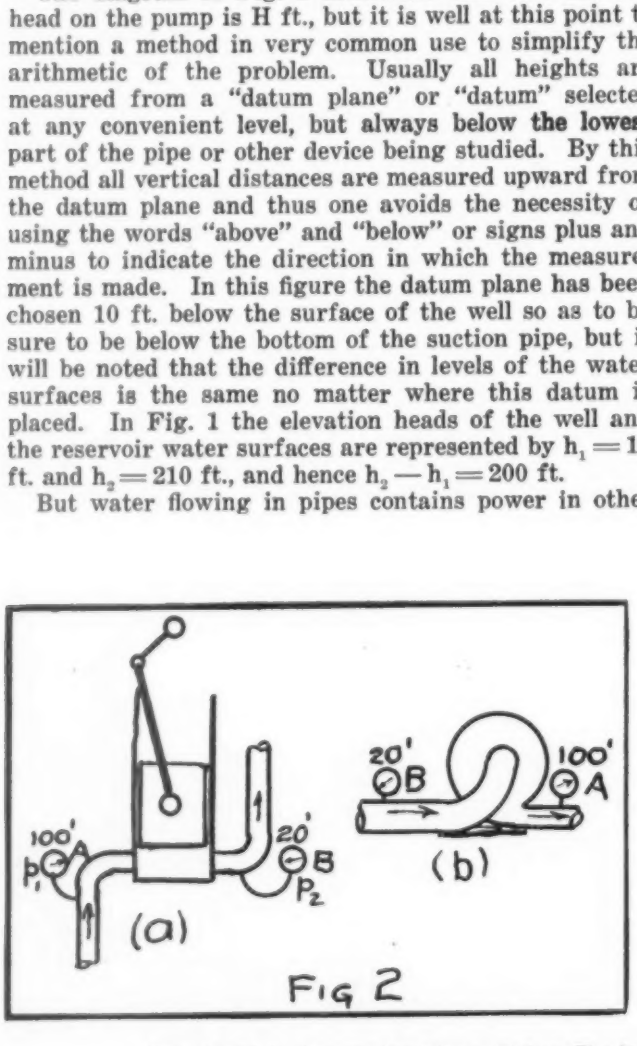


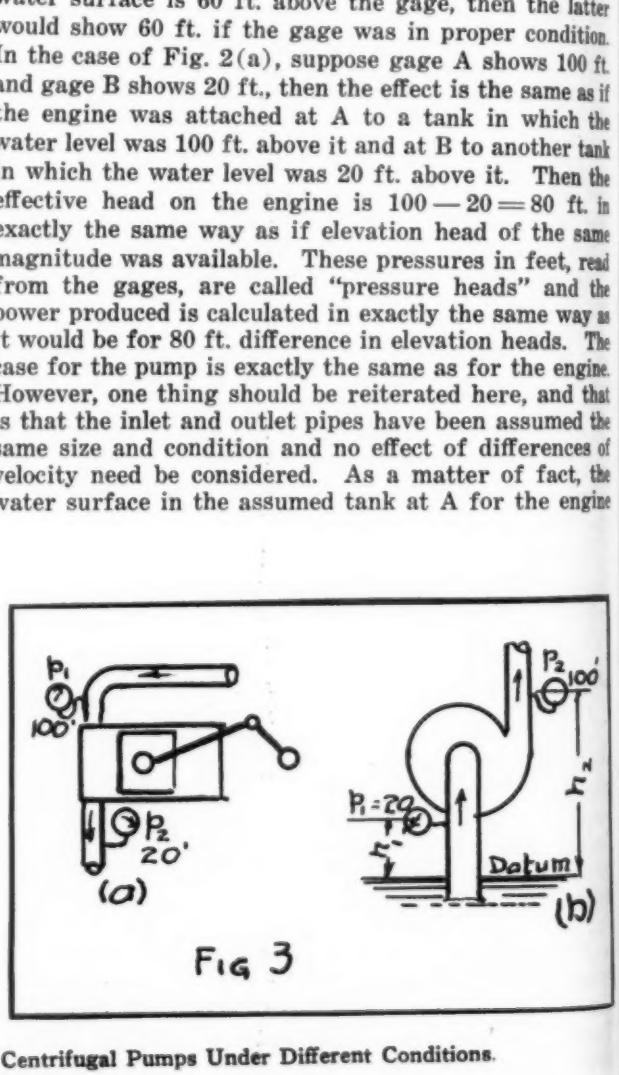
Fig. 1—Head and Power Relationships.

The diagram of Fig. 1 illustrates this case and the head on the pump is H ft., but it is well at this point to mention a method in very common use to simplify the arithmetic of the problem. Usually all heights are measured from a "datum plane" or "datum" selected at any convenient level, but always below the lowest part of the pipe or other device being studied. By this method all vertical distances are measured upward from the datum plane and thus one avoids the necessity of using the words "above" and "below" or signs plus and minus to indicate the direction in which the measurement is made. In this figure the datum plane has been chosen 10 ft. below the surface of the well so as to be sure to be below the bottom of the suction pipe, but it will be noted that the difference in levels of the water surfaces is the same no matter where this datum is placed. In Fig. 1 the elevation heads of the well and the reservoir water surfaces are represented by $h_1 = 10$ ft. and $h_2 = 210$ ft., and hence $h_2 - h_1 = 200$ ft.

But water flowing in pipes contains power in other forms than that due to elevation because often power is transmitted in a machine by or to water without any change in elevation taking place; this statement is true in most engines operated by water and in many centrifugal pumps, the power in these cases being due to a change in pressure of the water in the machine. This is illustrated in Fig. 2, where a water driven engine is shown at (a) and a centrifugal pump at (b), and in both cases it is assumed that the water enters and leaves through pipes of the same size and at the same level.

Gages at A and B on the pipe indicate the pressures, which may be in lbs. per sq. in. or in feet of water, as the gages are sometimes graduated in one unit and sometimes in the other, but rarely in both. If both graduations are used it will be found that 231 ft. of water is also marked 100 lbs. per sq. in. and this ratio of 2.31 ft. of water = 1 lb. per sq. in. pressure is the same all over the scale, but this matter will be discussed later. At present it will be assumed that the graduations are in feet of water and they mean that if, for example, the gage is attached to the base of a standpipe in which the water surface is 60 ft. above the gage, then the latter would show 60 ft. if the gage was in proper condition. In the case of Fig. 2(a), suppose gage A shows 100 ft. and gage B shows 20 ft., then the effect is the same as if the engine was attached at A to a tank in which the water level was 100 ft. above it and at B to another tank in which the water level was 20 ft. above it. Then the effective head on the engine is $100 - 20 = 80$ ft. in exactly the same way as if elevation head of the same magnitude was available. These pressures in feet, read from the gages, are called "pressure heads" and the power produced is calculated in exactly the same way as it would be for 80 ft. difference in elevation heads. The case for the pump is exactly the same as for the engine. However, one thing should be reiterated here, and that is that the inlet and outlet pipes have been assumed the same size and condition and no effect of differences of velocity need be considered. As a matter of fact, the water surface in the assumed tank at A for the engine





Figs. 2 and 3—Comparing Water Driven Engines and Centrifugal Pumps Under Different Conditions.

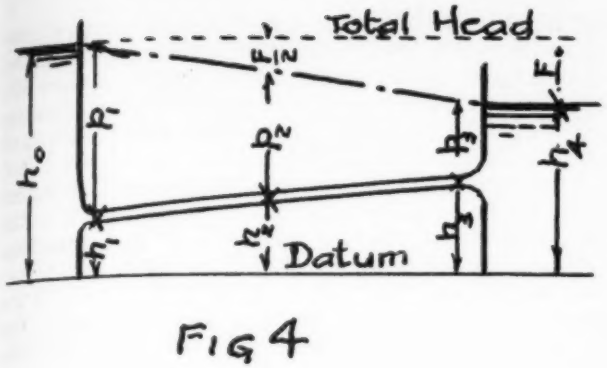


FIG 4

Fig. 4—Elevation and Pressure Heads.

shown at (a) would need to be more than 100 ft. above the gage because velocity and friction have to be considered, but in practice the effect of these is so small that at this stage they may be neglected in this case.

It often happens, however, that the inlet and outlet pipes are not at the same level. Such an instance is illustrated in Fig. 3 where the difference of levels of the gages is taken as 4 ft. If the gages in this case read 100 ft. and 20 ft., respectively, then in case (a) the engine not only gets the effect of the difference of pressure of 80 ft., but it also gets the benefit of the difference of elevation of 4 ft. and hence the effective head is the sum of the net pressure head and the change in elevation (or the elevation head), a similar statement being equally true of the pump. Therefore, to get the effective head acting at any point on the pipe, the elevation head is to be added to the pressure head. This may be illustrated very nicely in case of the pipe shown in Fig. 4, where the elevation heads are marked h_1 and h_2 and h_3 and the pressure heads p_1 and p_2 and p_3, and these are plotted to scale, but anyone who does not like the elegant graphical representation may, of course, just carry out the work by arithmetic. All inlet and outlet pipes are assumed in this case to be the same size, variations in these being left for later consideration.

Proper Interpretation Of Gage Readings

In finding pressures at any section under consideration, care must be taken in interpreting gage readings. The gage shows the pressure in the spring tube inside it and this may be the same as or different from that in the pipe at the point where the gage is connected. To illustrate this, imagine a standpipe filled to a depth of 60 ft. with water; the pressure at its bottom is 60 ft. and half way up it is 30 ft., and so on. If a gage connection is made in the side of the standpipe half way up and a gage attached so that its center is opposite the connection, such a gage will read 30 ft. of water; but if there is a run of small pipe running from the gage to the above connection and it is of such a length that the center of the gage attached to it is 10 ft. below the connection, then the gage will read 40 ft. of water; similarly, if the run of the small pipe is such that the center of the gage is 10 ft. above the point of connection, the gage will read only 20 ft. of water.

Where there is pressure greater than atmospheric it is necessary to correct the gage reading by adding the vertical distance in feet that the gage is above the point of pipe connection, or if the gage is below the connection, this vertical distance must be subtracted. The drawings are intended to indicate corrected pressures. This is done because the pressure due to the weight of water in the gage connecting pipe must be taken into account. If, however, there is a vacuum in the pipe to which the gage connection is made, as, for example, in the suction pipes of many pumps, and if care is taken to free the small pipe between the gage connection and the gage of all water, then the gage will read correctly the pressure at the point where the connection is made to the pipe, regardless of whether the gage is at the same level as this connection or not. If a gage connected directly (without intermediate piping) to a suction pipe should show a vacuum of 20 ft., this same gage would also read practically 20 ft. if it was lowered 10 ft. by using long piping free of water between the connection and the gage. Actually, there would be a slight difference due to the weight of the air in the small gage piping, but this would be insignificant. If, however, the gage piping becomes filled with water all the way from the gage to the suction piping, then lowering the gage 10 ft. would raise the pressure recorded by it by the same amount, that is, it would show a vacuum of only 10 ft. For vacuum gages it is good practice, therefore, to blow all the water out of the gage connection piping by opening, for a few seconds, a petcock connected to such piping close to the gage, and this cock should be opened at times during the day, as water may collect there.

Unless attention is paid to these points, quite serious misunderstanding of the gage readings may result. For instance, if as in the last case mentioned above, the gage connecting piping gradually fills with water, it is evident that the vacuum may change from an actual 20 ft. to an apparent 10 ft. Wherever possible, the gage connection should be short and both air and water tight, and it is best to attach the gage on the same level as the connection, but the latter point is not so serious. If the gage connection piping on a pressure gage leaks, errors often result in the gage indications because there is a definite pressure drop along the gage piping, but care must be taken that the connecting pipe is full of water and it should occasionally be blown out by opening the petcock near the gage so as to clear air from the gage pipe.

Friction and Resistance

Suppose now that gages are attached at some distance apart on a horizontal pipe of uniform size, then from previous discussion the gages should show the same

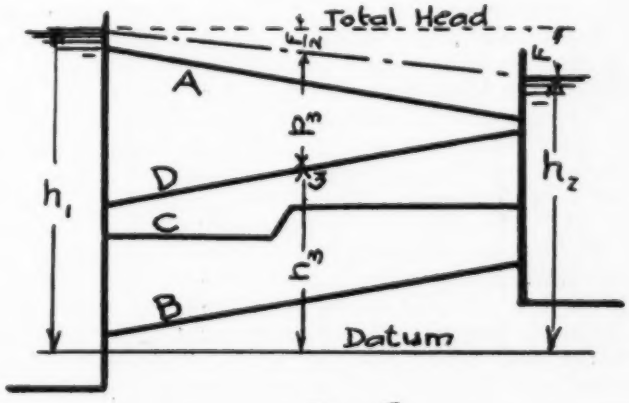


FIG 5

Fig. 5—Behavior of Pipes and Friction Effects

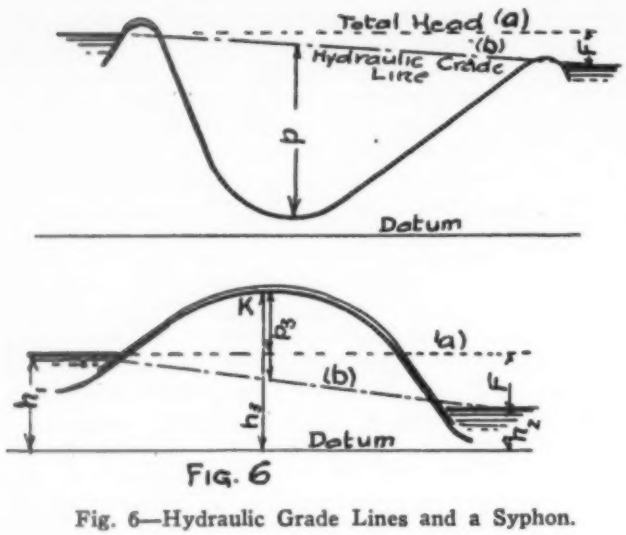


Fig. 6—Hydraulic Grade Lines and a Syphon.

pressure if there is no loss of power between them, but every practical man knows that with water flowing through the pipe the downstream gage always reads the lower of the two because of the known effect of friction of the water on the walls of the pipe. The difference in pressure increases as the distance between the gage connections increases, as the flow increases, and as the pipe gets older because it gets rusty and rough inside.

The whole question of friction will be considered by itself because of its great importance, but at present it is only necessary to call attention to its existence. The head lost in this way will be designated by F ft. and, for example, a centrifugal pump would have to lift the water from the well level to the reservoir level and, in addition, overcome the friction head F ft.

An interesting illustration is an intake pipe connecting a lake with a pump well on shore, and here observation shows that the water in the well is lower than the lake; briefly, the water will not flow in there if it is not. Now, in the well and in the lake a pound of water is only capable of doing work because of its elevation, and if a pound at the surface is considered in each case, since there is no pressure on it, this difference of levels must correspond to the motive force causing flow. But since the only loss between the lake and the well is in the pipe, then the difference of levels must represent the friction head F ft.; the more water that is drawn the greater the difference in the two levels, as is well known, because the pipe losses increase.

The loss of head in friction will evidently remain constant for a certain length of pipe of any given size and fixed discharge, that is to say, it is not affected by the location of the pipe. If an intake consists of 3,000 ft. of 30 in. pipe the loss in this pipe for a certain flow will be the same whether the pipe lies on the bed of the lake or 10 ft. above or 3 ft. below the bed and will be the same whether the pipe is horizontal or slopes upward or downward. The actuating force is proportional to the difference in levels between the lake and well or to the difference in their elevation heads. As this point is important, it will be desirable to dwell on it further. In Fig. 5 two open ponds are shown connected by four pipes which carry water from the upper to the lower pond. For the time being the effect of the velocity of the water will be left out of account; in most cases it is relatively small.

Now let it be assumed that the levels of the ponds do not change or that h_1-h_2 has a fixed value; then if the four pipes A, B, C and D are all the same length, diameter and internal smoothness, the discharge will be the same for each of the pipes, because under the same discharge the friction loss ($F = h_1 - h_2$) will be the same in each case. In the upper pond the only possible source of power is the elevation head h_1 and the horizontal dotted line extended from the upper water level will therefore represent the total head, F. At the mid-point 3 on the pipe D the friction loss is clearly ½ F and, therefore, at this point the elevation head plus the pressure head plus the friction loss (½ F) must make up h_1 if the effect of velocity is not considered for the moment. For the pipe D the elevation head is h_3 and hence the pressure head is p_3 as marked on the figure, since $h_1 = h_3 + p_3 + ½ F$. Clearly, the difference between the pipes A and C is that in the latter case all the pressures in the pipe are more than in the former, while for B the left hand end has much higher pressures than the right hand end of the same pipe.

Actually, it is always better, if possible, to have the pipe slope somewhat upward in the direction of flow as in the case of B and D, because air is sometimes present in the pipe and in case of B or D it would be carried through the pipe with the water, while in positions A and C it would be trapped there and would interfere with the flow.

A valley or a hill between the ponds may force the laying of the pipe in either of the positions shown in Fig. 6. For the valley in the upper figure the pressure in the pipe at the center is p, which is much higher than at other points and in the old Roman days when lead pipes of no great strength were available, the engineers had to carry water over such a valley in an open aqueduct because a pipe laid as shown would have burst.

For the intervening hill in the lower diagram of Fig. 6 the elevation head h_3 is greater than h_1 and hence the only way it is possible to have $h_1 = h_3 + p_3 + ½ F$ is to have p_3 negative or less than atmospheric. In other words, there is a partial vacuum at K and the pipe line becomes a siphon. If the partial vacuum at K is not too high, the line will work, once it is started, as every engineer knows by experience. There are objections to siphons, and these will be discussed as the articles continue. If the reader will take an ordinary pad and draw the diagrams roughly to scale, it will be most helpful. He can use such scales as 8 ft. to 1 in. vertically and 800 ft. to 1 in. horizontally, so as to magnify the points he is examining. Incidentally, the pipe line running from one reservoir through a valley and up to another is known as an "inverted syphon." Actually it is no syphon at all.

The Hydraulic Gradient

If on this scale drawing, Fig. 6, a horizontal line of total head is plotted, as at (a), and below it a line cor-

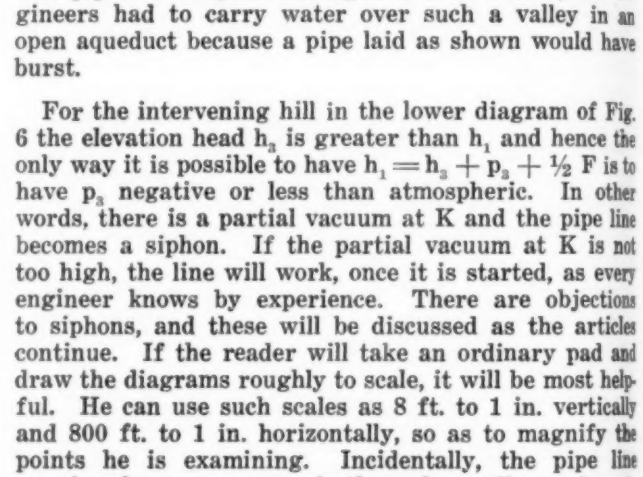


Fig. 7—Importance of the Hydraulic Grade Line and Pipe Line Design.

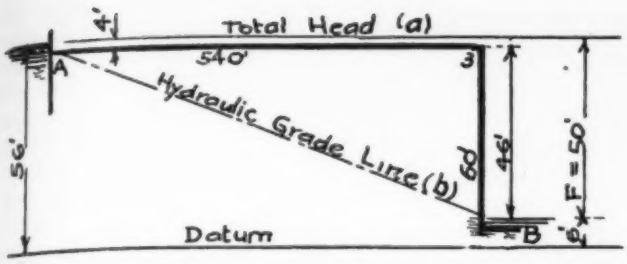


Fig. 8—Faulty Pipe Line Design and Poor Performance.

responding to the friction losses, as at (b), the whole conditions in the pipe are shown graphically. The line (b) will be seen to be practically straight, since in a uniform pipe the friction loss increases with the length only; it starts at the upper surface and finishes at the lower one, and if the reader will only have patience and try to grasp the underlying principles, he will be shown later how the exact position of the line (b) is found. The line (b) is commonly called the "hydraulic gradient" or hydraulic grade line. Wherever this line lies above the pipe there is pressure in the pipe, and where it is below the pipe there is a partial vacuum, and the pressure or vacuum in feet of water is just the vertical distance between the grade line and the pipe at that point. If velocity effect is included, as it should be, the pressure measured in the above way would, in a case of this kind, be reduced about half a foot, so that for the preliminary ideas velocity may be neglected.

These principles are most important in laying pipe and indicate that if the center line of the pipe is exactly on the line (b), or the "hydraulic gradient" line, there will be no pressure in the pipe, i.e., the water will be at atmospheric pressure. Since a perfect vacuum corresponds to a vacuum gage reading of 34 ft., it follows that the pipe must at every point be less than 34 ft. above (b). If the pipe is laid in uneven ground and rises and falls along its length but does not lie above the hydraulic grade line (b) at any point, as shown in Fig. 7, then although the pressure is always greater than atmospheric all along this pipe line, it is evident that points 0, 2 and 4 are at lower pressure than those at 1 and 3. As the water flows along the pipe it soon reaches a low pressure p_0, then a higher pressure p_1, then lower p_2, and so on.

All waters contain a certain volume of dissolved air, some much more than others. If the water is under high pressure the air is compressed and its volume is small, but as the water pressure is lowered the air expands and has a tendency to free itself from the water; such points as 0, 2 and 4 greatly facilitate this and experience shows that air actually comes out of the water and collects in the top of the pipe at such points; it will, of course, do the same thing and to greater degree at the highest point in a siphon. Since the pipe is commonly laid parallel to the surface of the ground, in all ordinary cases, it usually does have a shape similar to that of Fig. 7 and experience has shown that some means must be provided for bleeding the air out of the pipe at the points 0, 2, 4, etc. Sometimes cocks are tapped into the top of the pipe at these places and men go along occasionally and open them to release the air.

In cities and other built-up areas it is obviously impossible to do this and automatic air valves are installed at these points, one type of such valve being shown at Fig. 10. They all work on the same general principle of having a valve similar to that on a household toilet, where a float opens and closes the valve. This float rests on the water surface in the pipe and as the latter fills with air at the high point the float descends and opens the valve, releasing the air. The water entering the air-bled float chamber causes the valve to close again. In case of a siphon, the pressure at the high point is less than atmospheric and a vacuum pump must be used to exhaust the air. Because this process is rather inconvenient and expensive, siphons are not used except in unusual cases.

The points just discussed lead to some very unexpected results and show why, in some cases, there is a failure of a pipe line or a pump suction line to deliver water. Fig. 8 shows a pipe connecting two tanks with a difference of 50 ft. in level; the pipe is a fairly long one, the first part being nearly level and the vertical drop of 50 ft. occurs close to the end of the line. In this case, the friction loss F is 50 ft. in the entire pipe, and since the end 3 B is short, as stated, most of the loss will take place between A and 3. As a definite case, take the length A 3 as 540 ft. and 3 B as 60 ft., making a total length of 600 ft., then the loss from A to 3 is 90 per cent of F, or 45 ft., and the loss in 3 B is 10 per cent of F, or 5 ft.

Taking the datum 6 ft. below the lower surface, partly for convenience, and drawing the total head line (a) through the upper surface and assuming the part A 3 of the pipe is laid 4 ft. below this line of total head, it will appear that at 3 the elevation head is 52 ft. and, since the friction loss is $F_3 = 45$ ft., the figure shows that the total head, 56 ft. above the selected datum, would, at point 3, equal the elevation head of 52 ft. plus the pressure head, plus the friction loss of 45 ft. That is $56 = 52 + p_3 + 45$ or $p_3 = 56 - 97 = -41$ ft.

This diagram will correspond to a vacuum of 41 ft. of water, but as 34 ft. of water is the highest vacuum possible, the pipe will not work satisfactorily and will only deliver spasmodically. The pipe would have to be lowered at least 7 ft. at 3 to avoid exceeding the 34 ft. negative head. The preferred position would, of course, be along or below the sloping hydraulic grade line (b).

Without unduly laboring this point, attention might be called to another practical case. In Fig. 9 a pipe is laid from a spring to a cistern or a tank in the house, and although following the contour of the land, it never slopes upward in its length after the start, as shown. Such pipe lines often give trouble, as this discussion would suggest. Drawing the line of total head (a) and the hydraulic grade line (b), the first of which is straight and horizontal and the latter nearly straight and sloping nearly evenly from the spring to the cistern, the pipe crosses the gradient A B at points 5, 6 and 7, at which places there is atmospheric pressure in the

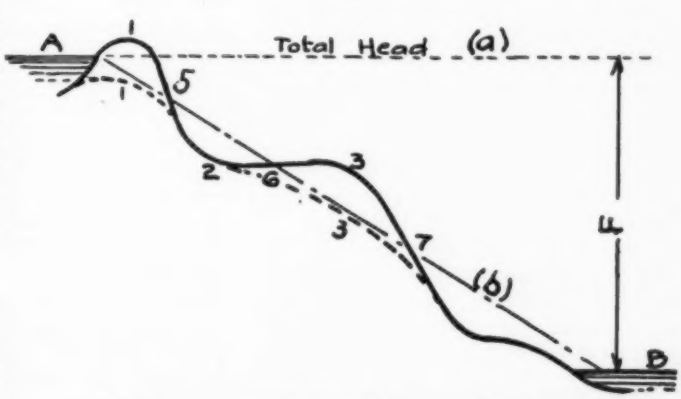


Fig. 9—Gravity Main Subject to Giving Trouble

pipe. At points 1 and 3 there is partial vacuum, and as these are "high points" on the line, air will usually collect in the pipe and the latter may become "air bound" and refuse to work at all. The line is then actually air blocked or air locked.

Placing air cocks at 1 and 3 does no good because opening them would admit air and make matters worse, but if the pipe was laid in the lower dotted position (2, 3, 7) air would still collect at 1 and 3 but it could be released by opening air cocks at these points, since the pressures are both above that of the atmosphere. The somewhat distorted appearance of the drawing is deceptive for the horizontal scale is often 100 times as great as the vertical, so as to magnify the conditions. It would be very enlightening to plot on a plain sheet of paper, with an ordinary steel scale, a case like the above, first with the vertical scale and the horizontal scale, both 80 ft. to an inch, that is, each ⅛ in. represents 10 ft., and then plot the same line with the same horizontal scale and with a vertical scale of 8 ft. to an inch. No great accuracy is needed in this plotting, and it should be done by anyone not familiar with the use of different vertical and horizontal scales on the same drawing, a practice almost always used by surveyors and engineers laying out pipe lines.

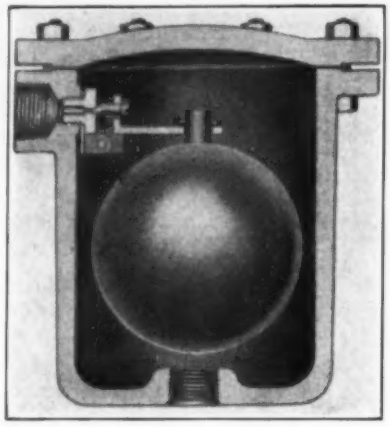


Fig. 10—Air Release Valve of Float Type.

(The first of a series of articles appearing in consecutive issues of *Water & Sewage Works.*)

Northeast Ohio Conference Holds First Post-War Meeting*

The Northeast Ohio Conference on Sewage Treatment held its first post-war meeting at the Cleveland Easterly Sewage Treatment Plant on May 23, of this year. One hundred

Part of group in foyer of Cleveland's Easterly Plant Adm. Bldg., waiting for call to dinner served by plant operating staff.

and nineteen persons attended the meeting, which included a tour of the plant, a discussion forum on plant performance, and a delectable dinner served in the basement of the administration building by members of the Easterly Plant operating staff.

Among the several topics discussed during the forum conducted by "Bill" Havens of Havens & Emerson, Consulting Engineers, Cleveland, were such things as digester covers, repair parts for equipment, digester heating, and hard surfacing for cutting elements in comminutors, shredders, etc.

Advantages and disadvantages of both floating covers and fixed covers were brought out. Stress was laid on the need for larger capacity digesters for activated sludge plants, with not less than 4 cu. ft., and preferably 6 to 7 cu. ft. per capita being indicated.

The high cost of repair parts and delayed deliveries of such parts was a lively topic, with cause of both being charged against some manufacturers.

Heating of sludge digestion tanks by external heating units received considerable attention with discussion centered on the installation of this type of equipment at the Cleveland Easterly plant.

A demonstration was made of a hard surfacing procedure with Stellite, Tungsten Carbide, and Tantalum Carbide. This demonstration created considerable interest in this development as a practical repair service on cutting elements used in sewage treatment equipment.

Among the many persons attending, who took part in the discussions was J. W. Ellms, Cleveland's venerable Commissioner of Sewage Disposal. Mr. Ellms is now eighty years old but retains an active interest in modern practice. Incidentally, he is now the lone survivor of the group which developed modern mechanical filtration of water at the famous Louisville Experimental Station.

*From notes supplied by John J. Wirts, Supt., Easterly Sewage Plant, Cleveland, O.

The Water Purification Division Sessions

The Water Purification Division sessions of the A. W. W. A. Convention will be reported in our next issue. This report was prepared by H. A. Faber, Editorial Associate, for printing in this issue, but because of the limit on pages for this issue, and the necessity of printing scheduled articles as well as meeting reports, it is necessary to hold the Water Purification Division report over for our August issue.—Ed.

Victor Weir Made President St. Louis County Water Co.

Also President of the Missouri Water Co.

W. Victor Weir, who served as co-chairman of the St. Louis Convention Committee for A.W.W.A., returned to his duties as General Manager of the St. Louis County Water Co., only a

W. Victor Weir

few days thereafter to find himself elected president of the company. At the same time he was made president also of the subsidiary Missouri Water Co.

Mr. Weir, long an ardent worker in the Am. Water Works Assn. which awarded him the Diven Medal in recognition of his work in the interest of the Association, joined the St. Louis County Water Co. as a Junior Engineer in 1923. Four years later he was made Engineer and Asst. Manager. In 1933 he became Chief Engineer and Superintendent and in 1945 was made a Vice President of the Company and General Manager of both the St. Louis County Water Co. and the Missouri Water Co.

Congratulations "Vic"! for having "what it takes" to become President of such a property as the St. Louis County Water Co. at such a ripe young age.

A.W.W.A. HOLDS MOST SUCCESSFUL CONVENTION OF ALL TIME

A Continuation of the Reporting of the St. Louis Convention

THE first installment of this report of the 66th Annual Convention of the American Water Works Association in St. Louis, Mo., May 6-10, appeared in our June issue. This is a continuation of the report and represents the concluding installment. We wish to report the registration figure of 1517 paid registrations, representing the all-time high in attendance for A.W.W.A. conventions.

"What's Ahead for Water Works?"

For a minute we are "putting the cart before the horse" by covering the closing session of the convention, which under the caption given above was intriguing enough to hold many members over for the final day. An expression of opinion of those attending this closing session was to the effect that it was the best part of the program.

It was in this session that **L. R. Howson** presented his paper on "Construction Costs and Water Rates," which was the subject of the editorial in our May issue, and constituted the lead-article in our June issue. We will therefore not attempt to review this outstanding timely paper here, but do wish to urge every water works man to study Mr. Howson's paper in the interest of making all water utilities self supporting and a little more.

The Federal Housing Situation

The session got under way with a brief review by A.W.W.A.'s Secretary, **Harry Jordan,** of the situation in National Housing and "The Federal Housing Program," followed by a look ahead in the matter of requirements for giving water service to the proposed 2,700,000 new dwellings within the next two years, with 1,200,000 of this number planned for completion in this year 1946.

(Ed. Note: It is understood from F.H.A. in Washington that already 1,500,000 permits have been issued for construction of new homes.)

Mr. Jordan highlighted the Wagner - Ellender - Taft Bill (Senate 1592), which is a long range housing plan bill calling for a permanent National Housing Agency which will have as its primary objective the creation of more homes for persons of moderate means and those in the low income brackets. He then went into more detail on the immediately active Wyatt program of the National Housing Agency which is covered in the recently passed housing legislation (H.R. 4761) in which the Federal Government is to make construction materials available and guarantee the market in order to insure rapid expansion of factory fabrication of materials and parts needed in the program calling for 2,700,000 new homes in two years.

Taking up the matter of planning for water service to these buildings, Mr. Jordan sees the possibility that the current Federal program in housing may require the water supply industry to extend its service during the next two years at a rate of 3 to 5 times that of prewar years. This situation becomes the more serious because of the already deferred extensions and maintenance work during war years, and the fact that water utilities generally had not yet been able to replenish their depleted inventories nor reestablish the lost manpower. On top of this, construction work planned for postwar has been stymied by slow delivery of materials, uncertain prices and expensive and inefficient labor.

Realization that the part to be taken by the water supply industry in the national housing program is an important key to its success, the A.W.W.A. office had recently reviewed with managers of water systems representing about 75 per cent of the buying power of the industry, the status of inventories of pipe, valves, meters, and other materials related to extensions and new services. How serious the problem is was revealed in the composite figures which indicate, for example, that with, on the average, nine weeks' supply of pipe on hand, delivery could not be had of pipe ordered sooner than 16 weeks; service line materials, nine weeks' supply on hand and no shipment assured until 16 weeks; valve and curb boxes, eight weeks' supply and 15 weeks before replenishment is obtainable; valves, fittings and meters, 10 weeks' supply and 14 to 15 weeks for delivery.

Mr. Jordan closed with the statement that with such a condition the water supply industry cannot per-

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Lincoln, Neb.

form its desirable part in the housing program until the Federal authorities take the necessary action to clear the way for greater productivity of manufacturers now stymied by inadequate price ceilings, insufficient labor and/or low productivity of workers. It is the intention of the A.W.W.A. office to keep driving home to the Federal authorities that water service to new houses will become another bottleneck unless conditions are corrected through subsidies, premiums or by a revision of O.P.A. policies relating to pricing vs. costs of manufacture.

Arthur E. Gorman, formerly chief of the Water Division in W.P.B., and now director of the Public Service Division in the National Housing Administration, Washington, in discussing this topic, stated that the priority system is again in force in connection with housing. In this direction the Civilian Production Administration is looking ahead to requirements of pipe, etc., for the water service. His advice to water utility managers was to tie in with the local C.P.A. committee in their community, since it is now the policy to have these citizen committees decide on the most essential local requirements and C.P.A. in Washington is guided by the recommendation of these local groups of citizens — not Federal employees. Where water works managers run into difficulties in procurement of materials they may resort again to war-time procedure in calling on him (Gorman) or Jordan for assistance or advice. He referred to the tightness of lead and the M-38 order of C.P.A. limiting its use in the water supply field along with others, and copper may again be put under like control.

New Equipment for Water Works

"New Equipment for Water Works," was the subject of a joint paper by **S. B. Morris,** Chief Engineer and General Manager, Department of Water and Power, Los Angeles, and **L. L. Camy,** Manager, California Water Service Co. (Los Angeles District). The paper was read by **L. E. Goit,** Deputy General Manager, Department of Water, Los Angeles, since Mr. Morris was called away from the convention.

The paper directed attention to the new pump control valve developed by the Clayton Mfg. Co. of California and an exhibit during the convention. In a plant of the California Water Service Co. this new valve had controlled line surge in a most satisfactory manner. Another product of the Clayton Co. had been a modulating float valve for use on an intake well to pumps supplying a standpipe equipped with elevation cut-off. Use of the modulating valve had changed pump cut-outs from 3 to 8 min. intervals to several hours between cut-outs. A reverse operating pilot valve on the intake well float energizes the discharge line valve to reduce pumping rates as the intake well elevation drops. [We wonder what the possibility is of the application of this modulating float valve in connection with direct pumping from wells, the end sought being that of automatically preventing excessive draw-down or intake of air by the well pump.—Ed.]

A sleeve type of check valve is now in the experimental stage. The advantage of this design is that such valves can be collapsed and lifted out of the line.

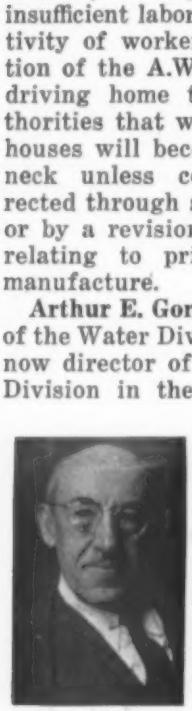
In the plastics and allied fields reference was made to the new silicone insulation for motors, permitting operation at high temperatures, also silicone varnishes resistant to heat and silicone lubricants for high temperature to subzero operations.

Messrs. Morris and Camy called attention to developments in pressure welding for excellent rapid welds—not yet perfected for fabrication of water pipe, however, but for other products. They referred to the introduction and progress with electronic control schemes, involving leased wire or radio; also to the advances in supervisory control through the telemetering principle and to automatic valve and pump station control now developed to a high degree with telephonic reporting of station conditions, water elevations, etc. In the category of laboratory equipment they singled out the x-ray type of machine for detection of hidden faults and flaws in metallic tubes, vessels, castings, etc.

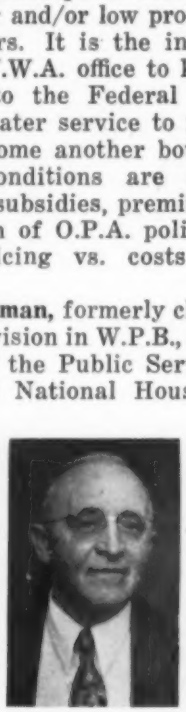
Problems of the Manufacturer

Col. W. F. Rockwell, President, Rockwell Mfg. Co., Pittsburgh, Pa., in reviewing the problems and possible program of water and sewage works manufacturers, repeated much that he had said earlier in the week in speaking at the Manufacturers' Luncheon. In commenting on present trends in prices and costs of equipment in general he said that a look back would convince anyone that inflation as we have it now, has actually been going on for 50 years. It was not something to fear but something to be prepared for. The type of inflation now facing us is not the kind in which money gradually becomes worthless but rather a re-valuation of the money in terms of what it will buy. He was loud in his condemnation of tactics and policies of the Office of Price Administration in refusal to raise prices while not holding down costs to the producer. Wages represent 45 per cent of the cost of water works equipment and now, with labor only 70 per cent efficient, the increase of 40 per cent in wages in reality is a net increase of 100 per cent in the cost of labor.

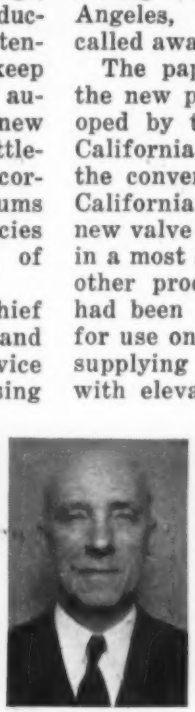
In looking ahead, Colonel Rockwell expects to see a levelling off of prices at about 50 per cent above prewar prices for all except products turned out by mass production. He concluded by suggesting



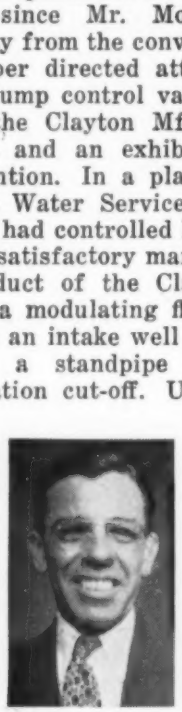
Jack Service
Publicity
Sparling Meters
Los Angeles, Calif.



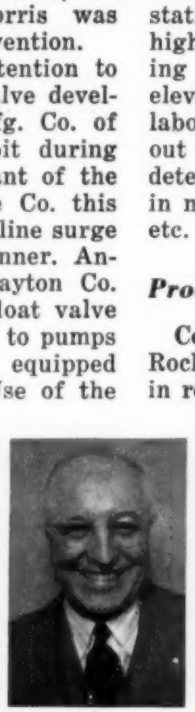
Clay Hemming
Mech. Engr.
Water Dept.
St. Louis, Mo.



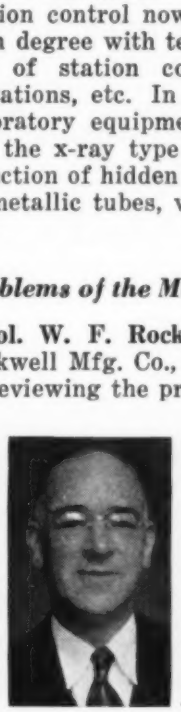
Chas. M. Roos
Manager
E. St. L. Wtr. Co.
E. St. Louis, Ill.



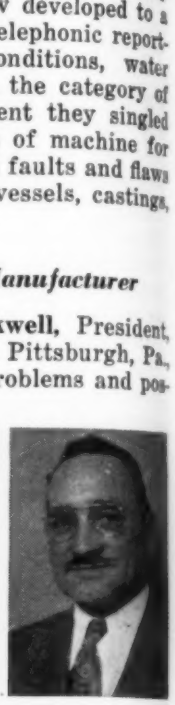
Rollie Le Veque
Sales Mgr.
Omega Mach. Co.
Providence, R. I.



Arthur P. Kuranz
Manager
Water Comsn.
Waukesha, Wis.



L. E. Goit
Asst. Chief Engr.
Dept. of Water
Los Angeles, Calif.



Richard H. Ellis
Engineer
F. Mutual Ins. Co.
Boston, Mass.

that nothing be built for the next year or two that is not absolutely necessary, but at the same time preparation be made for higher costs in the years ahead.

"HUMANICS"

A full session was devoted to "Humanics," which is a way of saying "How do you get along with your employees?" At the close there was an "off the record" discussion of this important problem.

Chairman for this session was **Philip B. Niles,** Assistant Vice-President, American Water Works & Electric Co., New York.

Employee Training

The matter of "Employee Training" was discussed by S. C. Casteel, Chief Engr., St. Louis & Interurban Water Co., East St. Louis, Ill., who reported enthusiastically on the 15 years' experience of the American Water Works & Electric Co. in employee training.

After briefly describing the training methods and classes held for employees, Mr. Casteel said that the informed employee makes the happiest and most efficient employee. He cited an example of explaining to employees the meaning of CO_2 in stack gas which had resulted in greater interest in boiler operation to the extent that $9,000 saving in coal alone resulted over a four-year period.

The company believes that, especially for all employees contacting the public, the axiom of "know the product you are selling," has paid dividends. In connection with classes of all grades of employees, one important consideration is that the instructors must at all times be honest and sincere in giving answers to questions from the employees. The company has found that loose leaf manuals are valuable in employee education and training, and a reading plan for all classes of employees has been used with reasonable success also.

In closing, Mr. Casteel mentioned the operation of the Merit Rating Plan as the only fair system of recognizing employee capacity and performance.

Developing Better Management

"How to Develop Better Management" was discussed by **H. W. Lundin,** Manager, Management Training and Public Relations Department, Monsanto Chemical Co., St. Louis, Mo.

Mr. Lundin began by saying the management improvement has lagged behind worker improvement in recent years. This points to the great need for training of foremen and superintendents. At Monsanto the executive committee of the company meets monthly with the management group where the exchange of ideas and a better knowledge of the company and its products is important to informed management. The foreman should be considered an important integral part of management. Until this is realized there can be no sustained and consistent improvement in management.

Pensions and Retirement Systems

Dale Moffitt was introduced by Chairman Niles as a former Chemist who had risen to the position of General Manager of the Water Works of Des Moines, Ia., and whose latest excursion had been into the field of developing a sound Pension and Retirement Plan for his employees.

Mr. Moffitt stated his belief that since the introduction of the retirement plan at Des Moines worker efficiency had improved along with the feeling of happiness and greater security on the part of the workers. In general, he said, failure to retire the older employees keeps out the younger progressive men and is costly on this score. An important consideration is that of providing a retirement fund ample to give the employee a reasonably adequate income.

The group insurance feature of the Des Moines retirement plan enables the employee to purchase additional insurance at a cost far below cost to him as an individual taker of insurance. Des Moines' experience is that the plan of having the employee contribute a share to the retirement fund has its distinct advantage. Since public relations usually "begin at home" the retirement plan has had its benefits in this category.

In reply to questions, Mr. Moffitt stated that on the average the employee will receive annually 1 per cent of his wages for the 5 years prior to introduction of the system and about ½ of 1 per cent of his wages for all prior years. If the employee leaves the Water Works he recovers only his own contributions plus 2 per cent interest for the period of contributions. The employee who was 65 years of age or older will yearly receive 4½ per cent of his average wage for 5 years prior to Jan. 1, 1946. The younger men, when retiring at 65, will receive between 58 and 60 per cent of his wages at the time of retirement.

G. E. Arnold
Asst. City Mgr.
San Diego, Calif.

E. J. Umbenhaver
Supt.
Water & Sewage
El Paso, Tex.

L. J. Hoffman
Office Mgr.
Dept. Wtr. & Sew.
Akron, O.

A. O. Fabrin
Pump Designer
Layne & Bowler
Memphis, Tenn.

H. S. Merz
Supt.
Water Dept.
Rockford, Ill.

Earl A. Smith
Distr. Mgr.
Badger Meters
Milwaukee, Wis.

W. F. McMurray
Engr. & Supt.
Water Dept.
Tulsa, Okla.

Union Relations to Municipal Plants

Wendell R. LaDue, Supt. and Chief Engr., Department Water and Sewage Disposal, Akron, Ohio, did one of his usual masterful jobs on this question of "Union Relations to Municipally Operated Plants."

With this important problem in the state of flux, Mr. LaDue pointed out that although municipal employee strikes are held illegal they continue to occur just the same. In the face of this the Circuit Court invalidated a Baltimore agreement with an employee union. The Florida Supreme Court now has a similar case before it from the Circuit Court. A New York court has denied subway employees a right to strike.

Mr. LaDue pointed out that arbitration is not possible in municipal operation because the municipal authority is not permitted to alter

the wage schedule; and, too, the question of Civil Service acts as an interference to collective bargaining and wage changes.

In closing, Mr. LaDue cited the recently enacted law in Virginia which states that any government employee who, in concert with two or more employees, brings on a strike is to be suspended for a full year without pay or ability to secure another governmental job in any capacity. This act followed on the heels of the Virginia governor's action in stopping a threatened strike of electric utility workers by drafting the lot into the Virginia State Guard.

W. R. Gelston, Supt. Water Dept., Quincy, Ill. and Chas. L. Fox, Supt., Penna. Wtr. Co., Wilkinsburg, Pa.

Jerry Manahan, Sales Mgr. and J. L. Atwell, Distr. Mgr. A. P. Smith Mfg. Co. East Orange, N. J.

R. E. Reed, Deputy Comr. and Geo. J. Van Dorp Comrs. of Water Toledo, Ohio

Union Relations to Privately Owned Water Plants

Van Horn Ely Jr., Manager, Philadelphia Suburban Water Co., Bryn Mawr, Pa., assigned this topic, pointed to the difficulty of job classification in water works operation. Further, water utility income varies but little through prosperity or depressions. He warned that any agreement to arbitrate may well put a water utility up against the wall with respect to its ability to manage its own plant in the future. Operating on the "closed shop" basis with a single union throttles management's ability to hire the best men and jeopardizes operations of a service in the interest of safety and public health.

The balance of Mr. Ely's paper constituted an explanation of the meaning of "closed shop," "union shop," "check off system" of mandatory dues deductions from employee wages, "seniority" and the "guaranteed annual wage" which he considered unconstitutional.

(Note: The discussion which followed the presentation of the prepared papers was of an "off the record" nature, the reporting of which is not permissible.—Editor.)

A General Session

At one of the three general sessions of the convention the program was devoted to such varied topics as leak locators, soil solidification, foundation treatment and utilization of rivers with three persons taking part in the discussion of the last item.

Chemical Soil Solidification

"Chemical Soil Solidification" is here to stay, according to **C. Martin Riedel,** of Chemical Soil Solidification Engineering Co., Chicago. Mr. Riedel, who won the 1946 Goodell prize for his paper published on that subject last year, presented a number of slides showing the application of the process.

This process, known as the Joosten process, involves the introduction of two chemical solutions into sand or unstable earth. The first solution forced into the soil contains sodium silicate. This is followed by the introduction of a solution of calcium chloride. The result after a period of setting is a hard impervious, solidified, and stable soil, capable of holding considerable load.

Mr. Riedel's slides showed a number of instances where the process had proved its worth in stabilizing soil for foundation work, or in stopping water inflow into concrete sewers or tunnels already constructed, as well as making it possible to construct tunnels through soft earth or running sand by the usual rock tunnelling methods instead of the involved and expensive methods necessary for earth tunnelling.

The process has also been used to stop leaks in concrete water tanks. In these cases, holes were drilled one-half way through the tank shells and the chemicals applied under pressure of 1200 psi. In ordinary soil work pressures seldom run up to 100 psi.

Foundation Treatment

In his paper on "Foundation Treatment," **L. A. Schmidt Jr.,** Consulting Engineer, Chattanooga, Tenn., first presented a number of definitions concerning conditions found in foundation explorations. Mr. Schmidt believes that the only way to prevent unbalanced bids is to have complete foundation explorations before the work is bid. As to the means of test exploration, Mr. Schmidt suggests either test pits or drilling with a split tube sample.

By means of slides, Mr. Schmidt showed methods of grouting at the proper elevation, asphalt grouting of leaking dams, and conditions under which admixtures are advisable to increase the speed of setting.

"Grouting is not a panacea for all problems" nor is one type of grouting applicable to all conditions. Each problem requires separate study.

Leak Locators

The paper by **G. R. Fisher,** of Fisher Research Lab., Palo Alto, Calif., consisted of a series of slide illustrations indicating how the M-Scope functions and the various technics of handling the different instruments for the purpose of locating leaks, or locating mains, stub ends, changes of direction of pipe, buried valves, etc.

Utilization of Rivers In the Public Interest

The "Utilization of Our Rivers in the Public Interest" was discussed from three points of view; transportation, valley authorities, and stream pollution.

E. B. Black, Cons. Engr., Kansas City, stressed the high cost of waterways routes, pointing out that on the Mississippi River alone construction had cost $180,000 per mile while maintenance costs $3000 per mile per year. Rail transportation is really the cheaper because water transportation has hidden costs amounting to $22,000,000 a year, which the taxpayer pays. Perhaps, however, this yearly subsidy is worth its cost, because without it, many manufacturers and attendant populations would have to move. Such wholesale transplanting of industry and population would be costly indeed.

Mr. Black commented on the slowness of water transportation, which is now used only for freight, passenger traffic having long since sought faster modes of travel.

In closing his talk after citing statistics and recommendations from the War Department reports, Mr. Black mentioned the use of the Missouri River for irrigation flood control, and the big public expense that will accrue if the Missouri Valley Authority is developed.

On the matter of procedure for utilization of rivers, **W. W. Horner**, Cons. Engr., St. Louis, and President of the Am. Soc. Civ. Engrs., decried the work of pressure blocs within and without the government. Such pressure blocs press for the development of schemes which are often economically unsound, if not impractical from an engineering standpoint.

The precedent of the development of valley conservation districts or authorities is the outgrowth of the gradual development of public corporations, beginning with school districts and followed by local drainage districts. The culmination of this development was the Tennessee Valley Authority for flood control and power development. While this "noble experiment" has been successful, Mr. Horner questions the advisability of covering the entire country with valley authorities.

The Missouri Valley does have a flood problem that must be solved, "but," says Mr. Horner, "That does not justify a Missouri Valley Authority of the paternalistic type."

Mr. Horner believes that there can be a sound basis of flood control and water resource conservation, and that such a program can be carried out by present agencies.

Stream Pollution and Federal Legislation

"The pollution of our rivers is obviously of public interest," said Abel Wolman, Prof. of Sanitary Engineering, Johns Hopkins University, as he began his talk on that phase of the subject. Although it is impossible to separate one use of rivers from the several, Dr. Wolman pointed out that, in the words of the late Theodore Roosevelt, "we have managed well to mismanage our rivers."

The present pollution load on our rivers consists of the domestic sewage from 47 million persons plus an industrial waste equivalent to 60 million persons.

During the past 25 years, the pollution of our rivers has been surveyed and studied seriously and progress in abatement of stream pollution has been tangible, but slow. Abatement of industrial waste pollution has been even slower than that for domestic sewage. As a result there have been two opposing viewpoints, that of the *Right* which believes that progress has been good, and that of the *Left* which believes that progress has been next to nil.

Actually, progress has been somewhere between these two views. At present, several states are deluging municipalities and industries with orders to abate pollution, while at the same time there is a trend toward Federal participation in the cleanup program. Two approaches by the Federal government were evident in the legislation proposed. The mild approach was exemplified by the Spence Bill (HR 4070), and the other by the Mundt Bill (HR 519).

Now, before the house is a compromise bill, HR 6024. In discussing this bill, Dr. Wolman defined "compromise" as a combination of the worst features of both of the other bills.

In reviewing the provisions of the new bill, Dr. Wolman pointed out that there will be practically no representation for the states or industry on the advisory board to the Surgeon General. The U. S. Pub. Health Service will have more power, will administer the bill, will classify waters, develop standards by regions, and will designate wastes injurious to any and all forms of life.

Under the proposed bill, the Federal government will in two years' time have regulating powers and will issue orders for abatement. Where the municipality or industry can not do the job technologically or economically, at least 5 years will be allowed before the cease pollution order is issued.

Dr. Wolman asked "How do we get into these positions?" and answered his own question by these two statements. First, industry's sins of omission run from carelessness at the least, to complete lack of responsibility at the most, and secondly, we have in this country, a sacred cow, namely that our rivers were meant to use as we saw fit including their use as a waste carrier. We don't, however, misuse our public roads in similar fashion.

"How can we overcome these attitudes and problems?" Industry must accept the cost of waste treatment as a legitimate cost of production. Sewers within industrial plants must be built properly to segregate deleterious wastes: A program must be developed to educate industry that not all waste treatment is a matter of income. "Too many industries," said Dr. Wolman, "have substituted legal advice for technological conscience." Were industry to attack the problem with anywhere near the intensity of effort given to other problems of production, waste treatment would soon be solved.

As to progress in the abatement of domestic sewage pollution, Dr. Wolman said that too many cities have been unconcerned because the waste does not affect them, only their neighbors; and too many cities are still waiting for Federal largesse although the municipalities themselves are in better financial condition than is the Federal government.

Dr. Wolman looks for passage of Federal legislation of strict nature unless the states accept responsibility for pollution abatement, at the same time they are crying for states rights to regulate their own affairs.

Nelson Thompson
Gen'l Mgr.
Homelite Corp.
Greenwich, Conn.

H. R. Reddington
Secy. Spec. Comm.
National Tube Co.
Pittsburgh, Pa.

H. L. Londo
Supt.
Water Dept.
Green Bay, Wis.

Thos. Starnes
So. Sales Mgr.
ACIPCO
Birmingham, Ala.

Walter S. Byrne
Gen'l Mgr.
Metro. Util. Comm.
Omaha, Neb.

Scotland Highland
Gen'l Mgr.
Water Board
Clarksburg, W. Va.

S. C. Casteel
Chief Engr.
E. St. L. Wtr. Co.
E. St. Louis, Ill.

MAY MEETING OF NEWWA IN BRIDGEPORT, CONN.

THE May meeting of NEWWA at Bridgeport was devoted mostly to inspection trips. In the morning a conducted tour was made of the Housatonic Plant of the Bridgeport Brass Co., where the manufacture of copper tubing and fittings was viewed.

Following the luncheon and the three papers presented there, more than a hundred persons visited the Saugatuck Dam of the Bridgeport Hydraulic Co. Stops were made at the various other reservoirs in the system. The photographs herewith show the spillway of the Saugatuck Dam, the discharge from the spillway, and the "fountain" discharge from the Saugatuck Reservoir into one of the distributing reservoirs.

Business Session

In addition to announcement of new members and voting to add $1000 to the budget, the session discussed the Mansfield Bill H.R. 6024 on stream pollution control. **Warren Scott,** Chief Engineer of the Conn. State Dept. of Health, read a report on the matter and expressed the consensus of the New England State Sanitary Engineers as being against sections 13, 14 and 15 of the bill.

Norwalk Lake Dam

J. E. Riordan, Engineer for the Board of Water Commissioners, City of Norwalk, First Taxing District, told of the "Construction of Norwalk Lake Dam". This dam is of the mass gravity concrete type and is 1012 feet long. Bids on the construction ranged 100 per cent from low to high. Earth excavation was bid at $2 per cu. yd., and rock excavation at $5. The job was 25 per cent complete at the time and was to be completed in 400 calendar days. Mr. Riordan doubts that the dam will be completed on time. One of the difficulties is obtaining supplies which must be ordered at least six months in advance of the time they are needed.

Saugatuck Dam

The Saugatuck Dam is 1180 ft. long and 125 ft. high, according to **Samuel P. Senior,** Pres. of the Bridgeport Hydraulic Co. The reservoir formed by this impounding dam covers 870 acres and holds 12 billion gallons of water. The formation of the lake required the construction of seven miles of relocated roads and bridges.

Mr. Senior gave some other interesting data on the construction of the dam, explaining that a low heat cement was used throughout, and that the downstream face of the dam was covered with earth as it was built up, to prevent freezing and spalling.

In spite of the fact that 2 billion gallons of water were used from the reservoir in the first year it filled within that year's period. By law the lake must release a minimum of 4 mgd. downstream to maintain a flow through the area below the dam. Two tunnels connect the reservoir with the distributing reservoirs nearer the city. The first tunnel is 5900 ft. long and the second 1900 ft. long. Both are six feet plus in diameter.

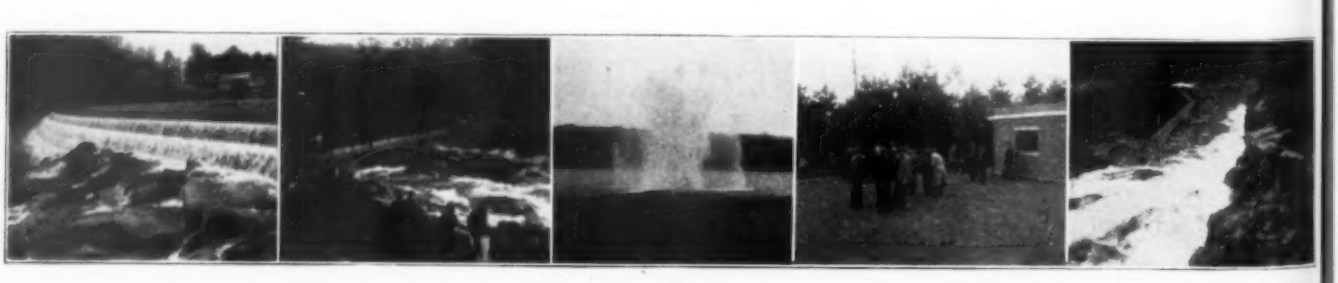
Free Residual Chlorination

In "Comments on Breakpoint Chlorination in Connecticut" **Frederick O. A. Almquist,** Principal Sanitary Engineer, Connecticut State Department of Health, explained that breakpoint chlorination, [now known as "Free Residual Chlorination," Ed.] is being used on 26 supplies by 13 utilities.

Citing examples from among these Mr. Almquist said that free residual chlorination not only eliminated tastes and odors but also improved the bacteriological quality of the water at the same time. In one instance where algae growth under ice was the cause of taste and odor troubles, the use of chlorine was effective.

Mr. Almquist listed several practical aspects of the establishment of free residual chlorination:

1. Time must be allowed to establish a free residual in a distribution system.
2. Chlorine doses should be increased slowly to prevent the dislodgment of material growths in the distribution system.
3. The process should be started in cold weather.
4. Once started free residual chlorination should be maintained continuously.
5. There is no hard and fast rule for the establishment of the proper rate of application of chlorine. Jar tests and the flash point test or the OTA test are recommended for control.
6. Before starting the treatment, one should be sure that the equipment available has sufficient capacity.
7. Contact time is important and should be ample.
8. Free residual chlorination will take care of sudden changes in chlorine demand without dissipation of the chlorine residual.
9. Prechlorination to a free chlorine residual gives better filter operation, but may cause filters to unload unless the dose is increased gradually.
10. The OTA test is recommended with a color comparator that has sufficient range.
11. There is some evidence that free residual chlorination will bleach the color from water.
12. Each water supply must have its own attention, as no set rules can be made for free residual chlorination; in this respect it is similar to any other treatment.



Inspection Trip

"WILLING WATER"

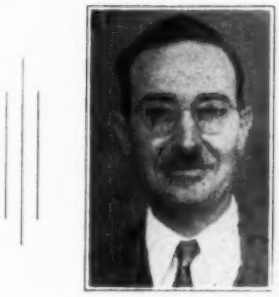
By A. H. ULLRICH
Chemical Engineer
WATER DEPARTMENT
FORT SMITH, ARK.

WOULD you like to have the "purest water there is" for use in your home? You probably think you do, but I doubt that you would be satisfied with it if you actually had it or could get it. Unfortunately, neither the water works profession nor the water utilities have taken the trouble to tell you much about the water you use. However, in 1943 the American Water Works Association did conceive a cartoon character which was named "Willing Water." This was given to the Water Works Industry for use in advertisements and publications. Perhaps you have seen it. At any rate, I should like to introduce you to "Willing Water," your ever ready, most versatile, most necessary, yet least expensive and least appreciated servant.

So much for the explanation of the title of my remarks. Now I want to try to show you how willing water really is. To do this I shall assume an average consumer and show what he thinks he wants, what he actually gets, what it costs him, and then what the water utility does with the money he pays.

What the Average Consumer Thinks He Wants

To show you what an average consumer thinks he wants let us assume that Mr. Ben Dees is our average consumer and that I am head of the water utility which serves him. For purposes of argument let us also assume that we have an ideal situation; that we have a complete new plant, new distribution system, and that the quality of the water produced can be changed at will. Now it is my earnest desire to give our average consumer exactly the kind of water and the kind of service he wants. So I ask him, "Mr. Dees, what kind of water is it you want, because that's the kind we will give you." He looks at me with an expression of consternation and says, "Sounds like a silly question to me. What I want is the purest water there is. What other kind of water would anyone want?" I explain to Mr. Dees that to give him that kind of water will require that we distill it, maybe double or triple distill it to get it really pure, but if he wants the purest water there is he shall have it.



The Author

Public Relations

This paper constituted an address given by the author before the Engineers' Club of Little Rock, Ark. Other addresses representing variations of this same theme have been given by him before civic groups in his home town of Fort Smith, Ark.

Mr. Ullrich, having found this personalized type of talk effective in arousing interest, comment and questions wherever given, has been considerate enough to offer it for publication in *Water and Sewage Works* as a possible guide to others contemplating similar talks dealing with the public and water quality.

Let this be an open invitation to readers to supply for publication copies of talks, which have proved most effective before nontechnical groups in an effort to inform the general public on water supply matters and arouse their interest.

So we distill all the water that goes through the plant and we pump it into the new distribution system and into the new storage reservoirs and we wait to see what happens. That night Mr. Dees goes home and he tells his wife that the new guy Ullrich is "kinda" goofy but he seems to want to do right. Then he goes and draws himself a drink of the new water and it tastes flat—it certainly does not taste like the best water in the world. This makes him wonder. He begins to think that guy Ullrich is really "goofy." Then, the next morning when he takes another drink and it tastes worse than the one the evening before, he comes by my office bright and early and says, "Mister, what are you trying to pull? You aren't giving us the kind of water I want. It tastes flat—it's no good." I calm him a little by taking him through the plant and showing him that we are actually distilling the water, and then I tell him that maybe he doesn't want "pure" water, but palatable, safe water. We agree to add a little salt for body and taste and since he thinks it should be livened up with air, we agree to blow some air through it.

That evening Mr. Dees goes home, takes a drink and smacks his lips because the water tastes fine. Later he takes a bath, and to his disgust, he finds that the water won't cut soap. He gets a luxurious lather with the soap but then he can't get the stuff off and his skin feels slick. Finally he slips in the tub and almost breaks his neck. Now he is really mad. Next morning he gets up and shaves. Again he gets a swell lather, but he can't wash the slick feeling off his face. On the way to work he stops at my office to register his second complaint—this time about "slick water." He informs me that he wants the water changed so he can get a decent shave and bath. I tell him that now I am convinced it isn't "pure" water that he wants, and that we will add a little hardness—just enough to make it cut soap.

That night Mr. Dees goes home, he draws himself a drink from the kitchen faucet and the water tastes excellent. Later he shaves and takes a bath and the soap lathers fine and, to his great pleasure, he finds that the water will also cut the excess soap. He is now satisfied, and at dinner he tells his wife that the gang down at the water office is a fine bunch of fellows.

After this last change in the quality of the water from a truly pure product to a slightly mineralized one, everything seems to be perfect. Mr. Dees is pleased, but in a few weeks he takes the improved quality as a matter of course and he neglects to commend the water utility on its efforts. This may be a blessing because the soft, aerated water is quite corrosive to iron pipe and in a few months Mr. Dees begins to get some red or rusty water at his home. Again he shows up at the office and demands to know what we are doing to ruin the water. We explain that while the water is ideal for drinking

and other domestic use, it is still corrosive to iron pipe and that to overcome this we will have to make it even less pure by adding some alkalinity in the form of lime. He says, "I don't care what you have to do—that's your problem—but do something."

We add some alkalinity without impairing the water quality and Mr. Dees is again pleased. But not for long. About thirty months later his two year old galvanized hot water tank springs a leak. He calls his plumber, who blames the water. This really "burns" him up, and again he wants to know what we are doing to the water to ruin it. We explain that no change has been made in the water—that we still add some air and a little mineral to make it taste good, a little hardness to make it cut soap and a little alkalinity to reduce its corrosiveness to iron, but that it is still too pure for satisfactory use in galvanized hot water tanks. We explain that because most galvanized hot water tanks are constructed with several different type metals contiguous to each other and in contact with heated water, they are really equivalent to electric batteries, and that unless the water deposits a protective film on these metals the tanks will "eat" themselves up. We explain further that we can stop this by adding some more hardness in the form of bicarbonate hardness which will form a protective scale, but we warn that the resulting water will, of course, be harder, possibly raising the hardness to an objectionable extent. Mr. Dees informs us that he doesn't care, just so we protect his hot water heater and save the high cost of replacement and plumber bills.

Now it isn't so easy to add bicarbonate hardness to a water which hasn't any, but since in our hypothetical plant we can do most anything, we do add this type hardness. Next day we receive complaints from the laundries, ice plants and a lot of the domestic consumers who do not have galvanized tank hot water heaters or who have not yet had trouble with theirs. All of these good consumers want to know what is going on and your humble servant is ready to take up some other line of business.

The foregoing experience is admittedly hypothetical but it can be surprisingly accurate in cities which change from a hard or medium hard water supply to a new, soft lake water supply. Many of the details can also be reasonably accurate in cities which decide to completely soften hard water supplies. So we, as water works men, are still searching for the ideal domestic water—ideal in that it will be completely satisfactory to the majority of our consumers.

Hypothetical to the Actual

Now I should like to change from the hypothetical to the actual. With the exception of a few details, the remarks which I still want to make could be applied to most water supplies. However, in order to be specific and to permit me to talk on conditions more or less familiar to you, I asked Mr. Jackson, Manager-Engineer of the Little Rock Water Department, for permission to use data taken from his 1944 annual report.

So far I have discussed the type water the average consumer, Mr. Dees, thinks he wants. Now I want to discuss the type water that he is actually getting here in Little Rock. Mr. Jackson's 1944 report shows that Lake Winona water, which is your water supply, has only 25.2 ppm. dissolved minerals, has a mean total hardness of only 12.0 ppm., and has practically no calcium or lime ("ppm" means parts per million or pounds per million pounds of water). It is probably saturated with oxygen (air), has a methyl orange alkalinity of only 9.0 ppm., a mean pH of only 6.4, but carries a mean carbon dioxide concentration of 13.0 ppm. (maximum 110.0 ppm.). In other words, the raw lake water is very similar to distilled water to which has been added as much oxygen (air) as it will dissolve and which has picked up fairly large quantities of carbon dioxide. The carbon dioxide forms carbonic acid in solution and accounts for the low (acid) pH. The raw lake water, of course, also carries some mud, bacteria and algae in suspension and, because of the algae, may have some tastes and odors.

While Little Rock's raw lake water approaches distilled water in its low mineral content, Mr. Jackson and his staff know that this type water is exceedingly corrosive to piping and would not be acceptable to their consumers. So here are some of the changes made in the water in 1944 as it passed through the plant: By adding some lime, the mean total hardness was increased from 12.0 ppm. to 21.0 ppm., the mean ethyl orange alkalinity was increased from 9.0 to 19 ppm., all the carbon dioxide was neutralized, practically all color was removed, the mean pH was increased from 6.4 to 8.5, the water was "scrubbed" (coagulated, settled and filtered) to remove all mud, algae and other suspended matter. The water was chlorinated to remove all harmful bacteria, some activated carbon was used to remove objectionable tastes and odors. Finally some "Calgon" was added to help the increased alkalinity and pH reduce corrosiveness. Unfortunately, we do not yet have an accepted method for removing dissolved oxygen from the large quantities of water involved in the treatment of a municipal supply or it is possible that such a treatment would also have been used, especially during the winter and spring months.

A Tailor-made Product

So, you see, what you actually get is a tailor-made water. From a raw material in Lake Winona your Water Department is converting every drop of water into the finished product which you draw from your kitchen or bathroom faucet at any hour of the day or night. Now what does this finished product cost you? Mr. Jackson tells me that "the average monthly domestic water bill in Little Rock for the year 1944 was $1.59. This translated into water consumption at 33.3c per thousand gallons is 4,775 gallons per month, that is, the average family in Little Rock used 4,775 gallons of water per month." Mr. Jackson states further that Little Rock's rate has been reduced some 6 per cent since 1944, so that now the average family, which he estimates at 4.74 person per account, pays only $1.50 for the 4,775 gallons which it uses per month. That amounts to 31.5c per person per month or just a shade over 1c per person per day. Or, in still other words, the average family here in Little Rock pays almost exactly one nickel a day for all the water they use.

Had you ever thought how much water you are buying for a nickel per day or $1.50 each month? 4,775 gallons, costing $1.50, is 39,775.75 pounds, or in round numbers, 20 tons. The cost to you in round figures is therefore about 7.5c per ton and for the nickel you spend per day you buy about two-thirds of a ton.

A Penny's Worth of Water Goes a Long Way

Now what do you do with this one cent's worth of water each of you uses each 24 hours?

1. You use it in the kitchen for cooking and dish washing. Your wife or maid uses a little for scrubbing floors, woodwork, etc.

2. You use it in the bathroom for shaving and bathing and for toilet flushing. Actually most of the water is used for sewage disposal. If you

still had an outdoor toilet the cleaning bill for it would likely cost you $12 a year or $1 per month.

3. Some of this water is used for family laundry work and you may use a little of it for washing your car.

4. In the summertime you may use a little for sprinkling purposes and you may use a little for a home air conditioner.

5. While you don't use much water for fire fighting, it is there for your protection. This saves you quite a lot in fire insurance but is an expense to the Water Department because of oversize main requirements.

6. And finally, unless you are like W. C. Fields, who, I believe, said that "water nauseates me," you probably use a little for drinking purposes.

You get all of this for one cent per person per day. If everyone paid for what he used each day few people would miss it. Do you still wonder why we call it "Willing Water"?

Now if you are an industry using more than 65,300 cubic feet per month you get the next 58,000 cubic feet for 11.5 cents per 100 cubic feet. This in round numbers is 3.7 cents per ton. Any amount you use in excess of 123,300 cubic feet per month costs you only 6.75 cents per 100 cubic feet. In round numbers this is less than 2.2 cents per ton. Dirt cheap? You couldn't have dirt moved that cheap, whereas you buy this manufactured product and have it delivered where you want it and when you want it at a maximum of 7.5 cents per ton for small quantities and a minimum of a little less than 2.2 cents per ton in large quantities.

Next, what does the Water Department do with the 2.2 to 7.5 cents per ton you pay them for water?

1. They try as nearly as possible to give you the kind of water you want. They "scrub" it to remove mud, algae, tastes and odors and bacteria. They treat it to some extent for anti-corrosion. They assume the responsibility of doing their utmost in protecting your health and property by giving you a safe water 24 hours per day.

2. They maintain and operate a property valued at some $7,246,-218.68 on December 31, 1944.

3. They improve and expand this property as demands increase.

4. They pay interest and retire the principal on something over $6,000,000.00 (as of December 31, 1944).

Maybe you hadn't given much thought to the size property you own in your water system. It's a pretty big concern for a city your size. In a great many, perhaps I should say in most cities, the water system represents the largest capital investment of any business in town. And while nature puts the water in your lake, it still isn't free. While the treating cost is not a major expense, the lake water must still be treated and it must be delivered to you. The chances are you hadn't thought of your Water Department being in the mass production manufacturing business. But it is. In 1944 your water plant treated and filtered 4,062,900,-000 gallons of water. 1944 was, I believe, a leap year having 366 days. The plant, therefore, treated on an average something over 11.25 million gallons per day. Or it processed about 47,000 tons each 24 hours and delivered it to the exact spot you wanted it. This amounts to better than 11 full freight trains each hauling one hundred 10,000 gallon tank cars each 24 hours.

Some Comparisons

In conclusion, I would like to give you some comparisons in the cost of the water you buy from your Water Department and the cost of other water you buy.

1. Milk is about 85 per cent water. If you pay 15c per quart or 60c per gallon it costs you $144 per ton.

The water department sells it to you for 7.5c per ton. The water in the milk costs you 1,920 times as much.

2. 100 proof whiskey is 50 per cent water. If you pay $5 per quart or $20 per gallon it costs you $4,800 per ton or $2,400 per ton for the water alone.

The Water Department sells it to you for 7.5c per ton. The water in the whiskey costs you 32,000 times as much.

If you have taken the trouble to read this article you are one of the 85,000,000 persons in the United States served by a public water utility who is interested in what he gets. Maybe your water supply is not as good as the one mentioned here or maybe it is better. However, of this I am certain: the water you use is the least expensive commodity you buy and the water utility which serves you operates on a smaller profit margin than does any other big business in your community. It is definitely not a money making business and because of its small profit margin it is sometimes unable to give you the kind of product it would like to give you. You have a very direct interest in the water utility which serves you, whether it is publicly or privately owned, and it behooves you to learn all about it you can. Then, I feel certain, you will give it your intelligent support.

Progress Notes on Latin American Sanitary Engineering Works

According to a recent issue of the Newsletter of the Institute of Inter-American Affairs, of which Col. Harold B. Gotaas is president, continued progress has been noted in the cooperative public health program in Latin America. As examples, the following projects are either under way or completed.

In El Salvador the sewage system has been extended at Cojutepeque for the population of 21,000. The original sewage system served only eight blocks.

Guatemala, Jutiapa, which is the capital of the Department of Jutiapa, and located on the Pan-American Highway with a population of 6,480 persons, had no water supply or sewer system. The study has progressed far enough now that construction has begun on the water supply system.

In Mexico public water supply systems have been the focus of much work since July, 1943, when the Mexican government and the Institute of Inter-American Affairs, representing the United States, signed their first agreement. Since that time 17 water projects have been undertaken including two for which agreements were signed only last January.

Also in Mexico, Ixtaltepec, a community of 6,000 persons, had no public water supply prior to cooperative public health programs, but one is under construction now.

Another public water supply is being built for the town of Espinal, a village of 3,000 population.

In Nicaragua both a water supply and sewage disposal study is being made for Matagalpa, a town of about 8,500 persons.

And in Leon, Nicaragua, the second largest city of the country with a population of 33,000, located on the Pacific coast, a study is under way to seek a solution to the water supply problem and to discover the best way to install a sewage system.

As more and more information becomes available, it is obvious that the sanitation program in South America is definitely on its way.

EUROPE'S BIGGEST EARTH-DAMMED RESERVOIR

By HUBERT E. BIRD*
LONDON, ENGLAND

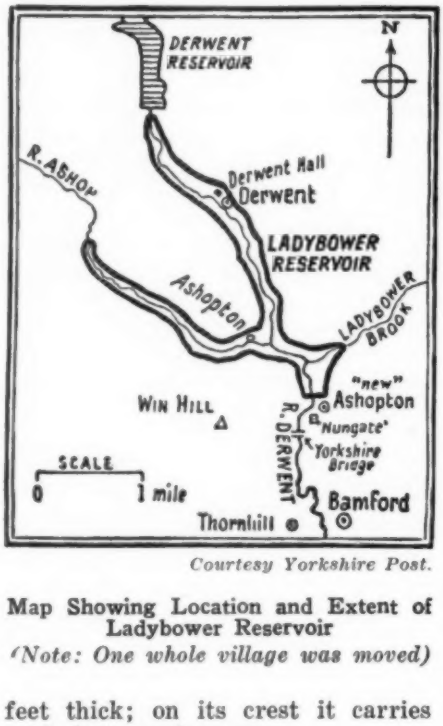
IN THE heart of England's most beautiful limestone country is a labyrinth of peaceful valleys where ancient farmsteads nestle in clumps of sheltering trees, and scores of little rivers babble over stony beds in summer and roar with demented speed in flood-time. To the west, the high outcropping bastions of Derbyshire's Peak District remain a world of wild and untouched beauty. To the east and south, in a widespreading arc, the crowded cities of Sheffield, Nottingham, Leicester and Derby lie, thirsty, throbbing centers of light and heavy industry. In these four cities, factories, furnaces and foundries have turned out all the mechanical and chemical instruments of war. With steam and fire the wheels were kept turning. Had either failed—but that wasn't the mood of war-time Britain, which saw in the impossible merely something that took a little longer.

Coal and water were the parents of Britain's industry, and actually in the years before World War II, the problem of ensuring an adequate water supply for these four cities had become a matter of acute concern. In the limestone valleys of the Peak country two big reservoirs had been built, into which, as the demand increased, the waters of two small rivers were diverted through a 1,000 yard tunnel.

Additional Water Supply Needed

Still the demand for a water supply increased, and in 1935 it was decided to build a third reservoir on a ten-year plan. World War II came, but the work advanced. Recently King George VI, with ceremony due to the occasion, opened the Ladybower Reservoir on scheduled time, and thus brought into operation the largest artificial reservoir formed by the construction of an earthwork embankment in Europe.

For reasons of local geology it was decided to make the dam of the Ladybower Reservoir an earthwork embankment with a clay core, under which a 200 foot deep trench was dug out and filled with concrete to prevent seepage. The dam, which is 1,250 feet long, holds back 6,300 million gallons of water, with a surface area of 504 acres, a perimeter of 13 miles and a maximum depth of 135 feet. At its base it is 665 feet thick; on its crest it carries a 17 foot carriage way.



Courtesy Yorkshire Post.

Map Showing Location and Extent of Ladybower Reservoir
(Note: One whole village was moved)

The main constructional problem in works of this sort is to prevent the water escaping either under or around the ends of the embankment. The concrete-filled trench running under the dam meets the first case. The second has been met by driving boreholes into the ground at each end of the embankment, and forcing cement grout under pressure into any faults and fissures in the neighboring strata, which would otherwise become natural escape routes for the reservoir waters. This was no light task, and 13,000 tons of cement were used to fill in boreholes going as deep as 400 feet. Their total depths amount to over eight miles.

Pumping plant, run on electric power generated by the normal outflow, will at capacity transfer to the aqueducts 53,666,000 gallons a day. When the reservoir is full, surplus waters are carried into the tail bays, not over the crest, through two 80-foot-wide funnel-shaped overflows.

Other Changes Necessitated

The upstream side of the embankment has been reinforced with local stone, which is fine millstone grit. This has also been used for retaining walls and the architectural features of the superstructure. Five miles of highway now under water have had to be rebuilt, including two great viaducts of reinforced concrete, which carry these new roads, as well as Post Office cables and two 48-in. water mains, over the arms of the reservoir, the cables and mains being laid in a tunnel passage under the road surface of the viaduct.

The increase in the volume of water has meant doubling water mains and filtration plant. More than 26 miles of new 48-in. mains have been laid, and the normal filtration processes supplemented with chemical treatment appropriate to the somewhat acid water of the peat moorlands.

It is a great testimony to Britain's faith in her own future that throughout World War II, which had many periods of sombre crisis and shocks, this work continued, in spite of the immense difficulty of obtaining the necessary labor and materials. Far from the whirring wheels of industry that they keep turning in factories, these quiet waters testify to that same persistence of spirit that brought final victory.

Russell Moore & Mark Owen Form Partnership

Russell B. Moore and Mark B. Owen have announced the formation of a partnership as consulting engineers, with offices in Indianapolis.

For the past year, Mr. Owen has been associated with Mr. Moore in the Russell B. Moore Co., and prior to that was Director of Research for the Am. Soc. of Civ. Engrs., on the matter of post war planning. Mr. Moore has been a consulting engineer in Indianapolis for a number of years.

In addition to sanitary engineering services, Moore and Owen have added analytical and experimental laboratory facilities for water, sewage, industrial wastes and garbage.

*Broadcaster and writer on industrial and civil engineering subjects.

MONTANA WATER AND SEWAGE GROUPS MEET IN BUTTE

A Report By
HARRY A. FABER*
Editorial Associate

THE Montana Sewage Works Association and the Montana Section of the American Water Works Association held overlapping meetings in Butte, April 11th, 12th, and 13th. Programs of the two groups were well planned; they set a high standard of technical discussions, provided a field trip, and were rounded out by social affairs. W. M. Gobleigh, Dean Emeritus, School of Engineering, State College, Bozeman, was chairman of the second annual meeting of the Sewage Works Association, while Fred Quinnel, City Manager of Bozeman, headed the A.W.W.A. section during its twenty-first annual meeting.

Out-of-state programmers included: George Schroepfer, Minneapolis; J. F. Fields, Denver; Wendell R. La Due, Akron; and Harry A. Faber, New York. The Butte Water Company was host at an inspection and luncheon at the Big Hole Pumping Station, nine miles from the city and on the Big Hole River. The arrangements for this trip were made by John B. Hazen, Superintendent of the Company and chairman of the Local Committee.

Eugene Carroll, retired Vice President and Manager of the Butte Water Company, was honored guest at the Dinner Dance in recognition of his fifty-five years of service to the water works profession. The Fuller Award recipient was A. L. Hewett, Superintendent of the Billings Water Department, who has made outstanding contributions to the growth of the section. A wallet and cigarette case were presented to H. B. Foote, State Sanitary Engineer, Helena, retiring as Secretary-Treasurer of the A.W.W.A. Montana section after serving tirelessly in that position for many years.

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

New Officers Elected

The Montana Sewage Works Association elected the following officers:

Chairman—Kenneth Chrysler, City Engineer, Billings

Vice-Chairman—K. J. Winebrenner, Operator, Sewage Treatment Plant Kalispell

Secy-Treas.—H. B. Foote, Div. of San. Eng., State Board of Health, Helena

Federation Director—Joe M. Schmit, City Engineer, Lewistown

Trustees—Fred Brandis, City Engineer, Chinook
F. F. Palmer, City Engineer, Forsyth

The Montana Section of the A.W.W.A. elected the following officers:

Chairman—Gordon J. Beiswanger, Cashier, Water Department, Billings

Vice-Chairman—Stewart Voden, Chemist, Great Falls

Secy.-Treas.—C. W. Brinck, Sanitary Engr. State Board of Health Helena

National Director—J. R. Cortese, Supt. of Water, Livingston

Trustees—B. F. Mercer, City Engineer, Sidney
J. B. Hazen, Supt., Butte Water Co.

Technical Papers

"The Fundamentals of Sewage Treatment," by W. M. Cobleigh, Dean Emeritus, School of Engineering, State College, Bozeman.

Dean Cobleigh summarized the wide scope and varied considerations involved in the treatment of sewage. Stream pollution problems must be related to the discharge of domestic and industrial wastes, considerations of water supply usage, and the capacity of the stream for self-purification. Basic principles of chemistry, biology, and physics apply in the determination of stream loading as well as in the selection of treatment processes.

The sanitary engineer employs nature's own methods of purification—under control and at accelerated rates. He selects the degree of treatment on the basis of conditions which determine the necessity for primary, secondary, or specialized handling. The irrigation of farm lands with raw sewage is not considered safe, but the desirable degree of treatment has never been specified. This question deserves further consideration in Montana, where considerable variation exists in effluent quality, in dilution available, and in the loadings of coliform bacteria.

"The Planning and Financing of Sewage Works," by George Schroep-

W. R. LaDue, Supt., Akron, O. (President of A.W.W.A.)

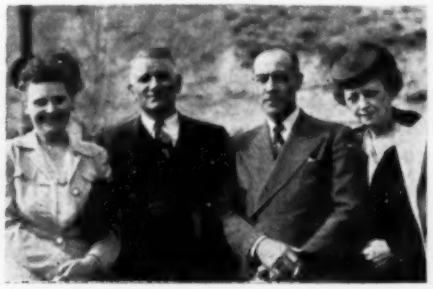
Mrs. Wendell R. LaDue

W. M. Cobleigh, Dean Emeritus State College of Eng., Bozeman, Mont. (Retiring Chmn., Mont. Swg. Wks. Assn.)

Mrs. Stuart Voden, Great Falls, Mont.

G. J. Beiswanger, Cashier Billings Water Dept. (The Section's New Chairman)

Mrs. Beiswanger, Billings, Mont.



Mrs. J. R. Cortese, Livingston, Mont.

J. R. Cortese, Supt., Livingston (National Director, A.W.W.A.)

H. B. Foote, Director, San. Eng. Div. Montana State Dept. of Health, Helena (Retiring Secy.-Treas., Mont. Section)

Mrs. H. B. Foote, Helena, Mont.

From Billings' Water Dept.

A. L. Hewett, Supt. (Voted the Fuller Award)

A. E. Heath, Supt. Distribution

M. F. Dixon, Plant Foreman

Mrs. H. L. McLaughlin, Denver, Colo.

Mrs. A. L. Hewett, Billings, Mont.

Mrs. C. B. Scott, Manager, Gardiner, Mont. (Owns and manages her own water works)

Fred Quinnell, City Mgr., Bozeman (The Section's Retiring Chairman)

"Bob" Millensifer, Johns-Manville Co. Great Falls, Mont.

A. E. Johnson, Foreman, Water Dept. Kalispell, Mont.

fer, Prof. of Sanitary Eng., Univ. of Minnesota, Minneapolis, Minn.

Professor Schroepfer reviewed the development which has taken place in sewerage and sewage treatment. According to a survey of the U. S. Public Health Service, there are about 8,400 sewer systems and the need exists for 7,700 additional. Cost estimates indicate 2.25 billion dollars are needed for construction of sewers, sewage treatment, and for the treatment of industrial wastes. Future progress in this field is likely to be influenced by federal bills.

Planning of sewage works begins at the local level, but is affected by factors such as: patents, standardized equipment, increased complexity of treatment methods, and qualifications of the man in charge. Consideration of legislation includes distinctions between that of state and federal authorities; the pros and cons of operator licensing was discussed.

The financing of sewage works is difficult to evaluate on the basis of prewar figures. Considerations of type and degree of treatment must take into account the need for special features and will be a decision of the designing engineer. Professor Schroepfer discussed generalized cost estimates for communities of 10,000 population—indicating that the total costs of sewers and sewage treatment will be from 1 to 2 cents per capita per day General tax obligation bonds, revenue bonds, and sewer rental charges were commented upon, the latter being recommended as most generally satisfactory.

"The Present Status of Sewage Treatment in Montana," by H. B. Foote, Director, Div. of Sanitary Eng., State Board of Health, Helena.

The history of sewage treatment in Montana starts with the first legislation passed in 1907 and continues with certain amendments passed since that time. Prior to 1910, there were only 16 sewer systems in the state and the number had grown to 29 systems in the next ten years, including 20 septic tank and 2 imhoff tank installations. The early progress of the State Board of Health was disappointing, indeed, but a distinct change in attitude was experienced in the period 1920 to 1940 when more consideration was given to stream quality.

Mr. Foote reported that, of the 115 incorporated communities in the State, there are now public sewers in 70 communities and that sewage treatment is provided in 42 of these. This rapid growth is due largely to personal evangelism of engineers and public health officials. Even greater acceptance of the need for improved sanitation has been apparent since 1940; the "Blueprint Now" program was widely adopted; and the time is approaching when no untreated waste (which will adversely affect stream quality) can be indiscriminately discharged. It is the function of the State Board of Health to analyze and evaluate plans under way—the expenditure of one million dollars is now planned and it is estimated that an additional nine million will be required in the State.

"Chlorination Practices of Today," by Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

Pointing out that a need exists for maintaining high standards of bacterial quality in water supplies, Mr. Faber discussed the means of controlling chlorination to meet such standards. The established chlorination practices have for some time been in need of clear definition and more exact understanding; it appears that the control of modern chlorination practices is now possible.

Actually, all chlorination practices may be divided into two types —that providing combined available chlorine residuals, and that providing free available chlorine residuals. These types differ largely on the basis of speed of disinfection and in the degree of oxidation accomplished. The ortho-tolidine-arsenite test, to be included in the forthcoming Standard Methods, provides a simple and sufficiently accurate means of controlling chlorination so that the desired practice can be followed. This test was demonstrated and its use was recommended, also, to prevent false residuals due to interfering substances in water.

"The Surplus Property Act and How It Works," by J. F. Fields, San. Engineer, USPHS, Denver, Colorado.

Under the regulations of this act, the first priority is given to Federal, the second to state, county, or local agencies, and then purchase by water, sewage, refuse, or hospital authorities is permitted. All purchasers are eligible for a 40 per cent discount. The U. S. Public Health Service acts for the War Assets Administration in determining the eligibility of applicants for surplus property.

Mr. Fields explained the difference between a letter of inquiry and an order. The purchase order must state the reason; that is, what specific public service will be benefited by the material and to what extent. The order must give specific shipping instructions, must be certified, and should be sent on the municipality's order form directly to the regional office from which the listing originated. The purchaser should inspect all items wherever possible; a wide variety of equipment may be obtained from this source if the purchaser has adequate patience and perseverance.

J. B. Ward, Hooker Electo Chem. Co. Tacoma, Wash.

Wm. Piatt, Engineer Butte Water Co., Butte, Mont.

A. W. Green, Hooker Electro. Chem. Co. Tacoma, Wash.

C. W. Brinck, Asst. Director of San. Eng. Montana Dept. of Health, Helena (New Secy.-Treas. of the Section)

Mrs. Brinck, Helena

C. O. Anderson, Cashier Butte Water Co., Butte

Bryan Shera, Penna. Salt Co. Tacoma, Wash.

Wm. J. Speir, W. & T. Co., Seattle

Roy N. Arnold, Water Dept. Manager Whitefish, Mont.

State Retirement Plan For Water and Sewage Employees

"Retirement Plans for Municipal Employees," by E. E. Lofgren, Secretary, State Public Employees Retirement System, Helena.

Mr. Lofgren discussed the Montana retirement plan, made effective in July 1945, which applies to all state employees who so elect, and is voluntary for city, county and school district employees. This plan provides that at age 65 and after 35 years of service those affected are entitled to half pay, while those with shorter periods of service receive fractional amounts. Among other benefits included in the plan are those for disability or death. By providing tenure of office and welfare of public service employees, it is believed that a higher level of personnel may be acquired.

"The Personnel Equation in Maintenance," by Wendell R. La Due, Supt. & Chief Engr.; Dept. of Water & Sewerage, Akron, Ohio.

While complimenting the Committee on Postwar Planning for its accomplishments, Mr. La Due was not hopeful concerning the changed picture of planned construction. Extensive shortages, strikes, and increased costs have necessarily restricted new building. Since possibilities of construction are limited, problems of maintenance are intensified. Deferrment of maintenance problems during the war has made such work even more necessary at this time.

Shortages in inventories apply to water and sewage plants, and to manufacturers as well. It was recommended that careful surveys be made of needs existing in municipal plants so that requirements can be maintained as far in advance as possible. The useful life of each factor in the system can be determined, and orders can then be planned for regular inspection and maintenance.

Mr. La Due pointed out that personnel wears out just as machinery does and should be given as careful attention. Since the waterworks industry serves 85 million consumers, represents an investment of 5 billion dollars, and employs 60 thousand people, the industry is of such size and importance as to warrant consideration of public relations. The A.W.W.A. has recognized the need for a definite program to benefit the waterworks industry in its relations with customers and is organizing a committee to work on this problem.

Round Table Discussion

The last item on the program was a round table discussion which brought out many subjects of wide interest. Considerable comment was devoted to the subjects of fiber pipe as a substitute for tile in sewers, and of Transite pipe as a substitute for iron. Much interest was shown in cathodic protection methods for the prevention of corrosion. Concern was expressed that veterans returning from overseas areas, where malaria is endemic, might make it necessary to devote more attention to mosquito control problems in this country.

Dr. Bach Murdered by Hitler's Gestapo

Dr. Imhoff Reported Living and Well

In a communication from Miss Anneliese Bach, daughter of Dr. Herman Bach, former chief chemist of the Emshergenossenshaft (Emsher River Board or Sanitary District), at Essen, Germany, we have learned of the sad fate of Dr. Bach. Miss Bach writes:

"I wish to inform you that my father was murdered in Berlin on January 7, 1944, by the Gestapo.

"A few weeks later our dear mother followed our father to her heavenly rest."

Dr. Bach had visited America on several occasions, and was known by many who have been wondering what might have happened to him, and to his former chief, Dr. Karl Imhoff. Now we have the sad news concerning Dr. Bach, but have been informed that Dr. Imhoff is happily still living, and in good health, somewhere in Germany.

New England Ass'n Nominates Officers

Such Nominations Being Tantamount to Election of the Entire Slate

Reporting for the Nominating Committee of the New England Water Works Association, Chairman Warren J. Scott has presented the following nominations for offices during the year following the N.E.W.W.A. Convention, to be held September 17-20 at Poland Spring, Me.

For President
Arthur L. Shaw, Partner, Metcalf & Eddy, Engrs., Boston.

For 2d Vice-President*
Arthur C. King, Supt., Water Dept. of Taunton, Mass.

For Director
Philip J. Holton, Jr., Chief Engr., Water Board, Providence, R.I.

For Treasurer
William P. Melley, Supt., Water Dept. of Milton, Mass.

*Note: Automatically the 2nd Vice-President, elected for two years, becomes 1st Vice-President after one year of service in the junior position; consequently Don C. Calderwood, Chief Engr., Nashua, N. H., will become 1st Vice-President for 1947.

SURVEY OF ELEMENTARY MATHEMATICS

For Water and Sewage Works Operators

Part III

By WARREN K. EGLOF, Ph.D.
Prof. of Chemical Engineering
NIAGARA UNIVERSITY, N. Y.

Algebraic Signs and Symbols

An algebraic symbol is a letter representing a definite object or thing. The idea of quantity is always present. Algebraic signs indicate quality, aggregation, or operation.

Addition $a + b$
Subtraction $a - b$
Multiplication $a \times b$ or $a \cdot b$ or ab
Division a/b or $a \div b$ or $\frac{a}{b}$
Powers $a \times a = a^2$
$a \times a \times a \times \ldots$ n times $= a^n$
Square root $\sqrt{a} = a^{\frac{1}{2}}$
nth root $\sqrt[n]{a} = a^{\frac{1}{n}}$
Fractional exponent—

$$a^{\frac{m}{n}} = (a^{\frac{1}{n}})^m = (a^m)^{\frac{1}{n}} = \sqrt[n]{a^m}$$

Meaning of Signs

The signs (+) and (—) have two distinct meanings in algebra. They are signs of operation for addition and subtraction. For addition or subtraction, they are read "plus" and "minus". They are also signs of quality and are read "positive" and "negative". Positive and negative mean "opposite." One must be given a meaning, whereupon the other becomes the opposite. If distances upward are arbitrarily marked positive, distances downward are negative. Credit may be marked positive and indebtedness negative. Pressure may be positive and vacuum negative. Temperatures above zero are positive and below negative.

Examples of Algebraic Operations

$$(+a) + (+b) = a + b$$
$$(-a) + (+b) = -a + b = b - a$$
$$(-a) + (-b) = -a - b = -(a + b)$$
$$(+a)(+b) = ab$$
$$(-a)(+b) = -ab$$
$$(-a)(-b) = +ab$$
$$n(a + b) = na + nb$$
$$-n(a + b) = -na - nb$$
$$-n(a - b) = -na + nb$$
$$\frac{-a}{+b} = -\frac{a}{b}$$
$$\frac{-a}{-b} = \frac{a}{b}$$

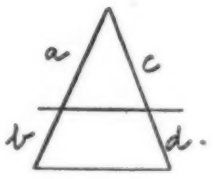
Signs of Aggregation

The signs of aggregation usually used are parentheses ( ), brackets [ ], braces { }, and vinculum —. An expression within a pair of signs of aggregation must be treated as a unit. To remove signs of aggregation, start with the innermost pair and work outwards.

$$\{6 - [2 - (8 - 2)]\} = 10$$

Rules for Exponents

$$a^m \times a^n = a^{m+n}$$
$$\frac{a^m}{a^n} = a^{m-n}$$

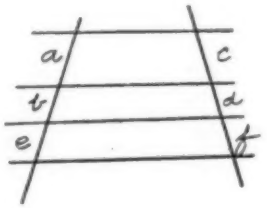


A line parallel to the base of a triangle divides the other two sides proportionally.

$a : b = c : d$

$(a+b) : b = (c+d) : d$

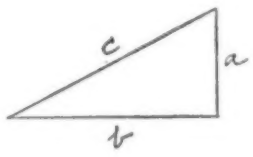
$(a+b) : a = (c+d) : c$



Any two lines cut by three or more parallel lines are divided into proportional segments.

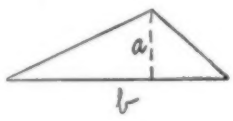
$a : b = c : d$

$b : e = d : f$

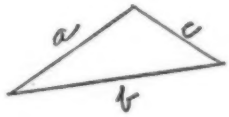


The square of the hypotenuse is equal to the sum of the squares of the other two sides for any right triangle.

$$a^2 + b^2 = c^2$$

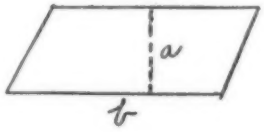


Area of any triangle = $1/2\ ba$

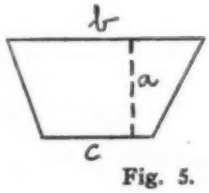


Area of any triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

where $s = 1/2(a + b + c)$



Area of any parallelogram = ba



Area of a trapezoid =

$$1/2(b + c)a$$

Fig. 5. Proportional Relations and Areas of Plane Figures

$$(a^m)^n = a^{mxn}$$
$$(a^m)^{\frac{1}{n}} = a^{\frac{m}{n}}$$
$$a^{-m} = \frac{1}{a^m}$$

MANIPULATION OF A FORMULA

In using a formula for calculation, rearrangement is frequently necessary to isolate the variable whose value is to be computed. Given the following formula, isolate x.

$$\sqrt{k} = \frac{x^2y + 5z}{3} + 6$$

Principles Governing Rearrangements

The following principles govern rearrangements:

(a) Equals added to or subtracted from both sides of an equation do not alter the equality.

(b) Equality is not altered if both sides of an equation are divided by the same number.

(c) Equality is not altered if both sides are multiplied by the same number.

(d) Equality is not altered if equal powers and roots are applied to both sides.

If —6 is added to both sides above,

$$\sqrt{k} - 6 = \frac{x^2y + 5z}{3}$$

Multiply both sides by 3

$$3\sqrt{k} - 18 = x^2y + 5z$$

Add —5z to both sides

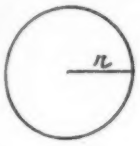
$$3\sqrt{k} - 18 - 5z = x^2y$$

Divide both sides by y

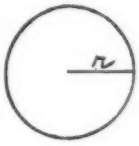
$$\frac{3\sqrt{k} - 18 - 5z}{y} = x^2$$

Take square root of both sides

$$\sqrt{\frac{3\sqrt{k} - 18 - 5z}{y}} = x$$

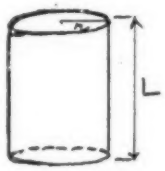


Area of a circle = πr^2



Area of sphere = $4\pi r^2$

Volume of sphere = $1/6\pi d^3$



Lateral area of cylinder = $2\pi rL$

Volume = $\pi r^2 L$

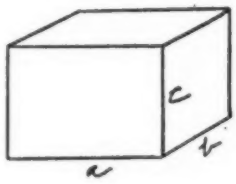
Volume of cone = $1/3\pi r^2 a$

Volume of pyramid = 1/3 (area of base)a

Volume of frustum of cone or pyramid=

$V = a/3(A_1 + A_2 + \sqrt{A_1 A_2})$

A_1 = area of one base
A_2 = area of other base

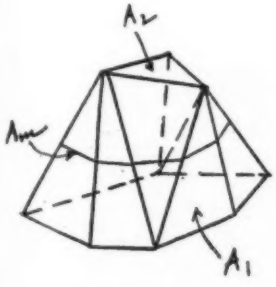


Volume of cube, rectangular basin, or any parallelopiped =

v = area of base x altitude

for rectangular objects

v = a x b x c



A prismatoid has bases that are parallel polygons and sides that are quadrilaterals or triangles. One base may be a point or line.

$V = a/6(A_1 + A_2 + 4A_m)$

A_m is the area of the mid-section

Fig. 6. Areas and Volumes of Plane and Solid Geometrical Figures

AREAS AND VOLUMES

Areas and volumes of various geometric figures are shown in Figs. 5 and 6.

LOGARITHMS

Logarithms are exponents. Their use saves time and labor in extended calculation involving only multiplication, division, roots, and powers. Some calculations can be made in no other way. The understanding of pH requires their use. Consider

$N = a^x$ where
N is any number
a is a constant called the base
x is a variable exponent that changes when N changes

For common logarithms, the base is 10 and hence, $N = 10^x$ where x is the logarithm to the base 10 and is written log N = x. The logarithmic system is evident from the following tabulation:

$1 = 10^0$
$10 = 10^1$
$100 = 10^2$
$1000 = 10^3$
$1{,}000{,}000 = 10^6$
$0.1 = 10^{-1}$
$0.01 = 10^{-2}$
$0.001 = 10^{-3}$
$\log 1 = 0$
$\log 10 = 1$
$\log 100 = 2$
$\log 1000 = 3$
$\log 1{,}000{,}000 = 6$
$\log 0.1 = -1 = 9.0000 - 10$
$\log 0.01 = -2 = 8.0000 - 10$
$\log 0.001 = -3$

Observe that since the log 1 = 0 and log 10 = 1, the logarithms of all numbers between 1 and 10 are numbers between 0 and 1. For example $3 = 10^{0.4771}$ or log 3 = 0.4771.

Any number can be written as a number between 1 and 10 times some power of 10. Observe the following:

$137 = 1.37 \times 10^2$
$22740 = 2.2740 \times 10^4$

$0.0247 = 2.47 \times 10^{-2}$
$0.0004735 = 4.735 \times 10^{-4}$

The power of 10 is equal to the number of decimal places thru which the point has been shifted, positive if moved to the left and negative if moved to the right. In Fig. 7 the table of logarithms shown is a four place table. All numbers with more than four significant figures should be rounded off to four figures before entering the table. A four place table is sufficient for most purposes.

How to Find a Logarithm Of a Number

Find the log of 467.8 in the table. Assume that the table gives the logs of numbers from 1 to 10 only. Mentally shift the decimal point in 467.8 to 4.678 x 10^2. Enter the table with 46 in the extreme left column and proceed horizontally until the column headed by the third figure of the number is reached. Result up to this point is 6693. Again proceed horizontally until the column in the table of Proportional Parts, headed by the fourth figure in the number is reached. Here we find 7. Add this 7 to 6693 and we have 6700 or 0.6700. This 0.6700 is the log of 4.678. With this we must combine the log 10^2. The log 10^2 is 2. When numbers are multiplied, their logs are added, hence 0.6700 + 2 or 2.6700 is the log of 467.8.

Find the log of 0.007284 in the table. Shift the decimal point so that the number becomes 7.284 x 10^{-3} and enter the table with 7284.

$\log 7.284 = 0.8623$
$\log 10^{-3} = -3$
$\log 0.007284 = 0.8623 - 3$

Important: Logarithms written in the form 0.8623—3 may be changed in form but not in value by adding the same quantity to both the 0.8623 and the 3. The 0.8623—3 can be written as 7.8623—10 or as 5.8623—8. For logarithms of numbers less than one it is important to recognize that (a—b) = (a+n) — (b+n).

How to Find a Number, Given the Logarithm

Find the number whose logarithm is 1.8423. Mentally change this to 0.8423+1. Enter the body of the table and locate 8420 which is next lower than the given 8423. Opposite the 8420 is 69 and above the 8420 is column heading 5. Our number so far is 6.95. Next, 8420 is 3 less than 8423. Go horizontally from 8420 until 3 is reached in the table of Proportional Parts. This 3 is in the column headed by 5. Our number so far is 6.955 determined by the 0.8423 part of the logarithm. The +1 means that the 6.955 is to be multiplied by 10^1 or our final number is 69.55.

Find the number whose logarithm is 0.5842—2. From the tables the number whose log is 0.5842 is 3.839. The —2 means that 3.839 is to be multiplied by 10^{-2} or our final number is 0.03839.

Problem: Calculate the following

$$\sqrt[3]{\frac{4.230^2 \times 153.7}{0.001972}}$$

$\log \text{answer} = 2.0481$
$\text{answer} = 111.7$

Rules used for the above example are:

$$\log a^n = n \log a$$
$$\log ab = \log a + \log b$$
$$\log \frac{a}{b} = \log a - \log b$$
$$\log \sqrt[n]{a} = \frac{\log a}{n}$$

Natural Numbers	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	17	21	25	29	33	37
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14	17	20	22	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12	14	16	19	21
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4

Fig. 7. Table of Logarithms and Proportional Parts

N.E. SEW. WKS. ASSN. HOLDS SPRING MEETING IN GREENWICH, CONN.

GREENWICH, Conn., is just inside the state line on the New York side and a long way from the geographical center of the New England States, but that didn't deter a goodly number of New Englanders from attending the Spring meeting of the NESWA held in Greenwich on May 17. With a dozen or more guests from New York, the total attendance topped 110 persons.

Officers

President
George H. Craemer
Supt. Sew. Treat.
Hartford, Conn.

Secretary
Walter E. Merrill
State Dept. Health
Boston, Mass.

Business Meeting

Business meetings are often boring affairs at technical meetings but this one *was* an exception. In spite of a late start and a full program, a lively interest on the part of the members kept this business meeting going beyond its allotted time.

First there was **Stuart Coburn,** of Metcalf and Eddy, Boston, who reported, as chairman of the membership committee, a gratifying gain of 22 members during the past year. Of these 14 were from Massachusetts, 7 from Connecticut, and 1 from Rhode Island. The total membership as of that date stood at 203.

Thomas R. Camp, Cons. Engr., Boston, and Chairman of the Committee on Operators' Salaries, gave a progress report, stating that the committee was circulating a questionnaire to all of the local plants in the New England area as well as the larger plants throughout the country. A final report is to be presented at the Fall meeting.

At the Fall meeting in Springfield, Mass., last year, the subject of sludge fertilizer was discussed by Dr. Lunt of the Connecticut Dept. of Agriculture. Following his paper, the association appointed a committee, headed by **J. Henry Giles,** to study and develop a sound experimental program for the determination of the effectiveness of sewage sludge additions to crops. Mr. Giles reported that his committee had succeeded in preparing a set of instructions with the help of the Dept. of Soils of the Conn. Agr. Expt. Station, but that the work had not been completed in time for much of the spring planting. The directions were available and inasmuch as they are of interest to persons all over the country, these instructions are printed at the end of this report. A form accompanies the instructions for the purpose of reporting results in a uniform manner. A copy of this form may be obtained from Mr. Giles.

Federal Legislation
Warren E. Scott
Chief Engr.
Conn. Dept. Health
Hartford, Conn.

Federation Affairs
Francis S. Friel
Vice President
Fed. Sew. Wks. Assn.
Philadelphia, Pa.

Mr. Giles remarked that the National Agronomy Association now has a committee on the study of sewage sludge as fertilizer or as a soil conditioner, as some persons prefer to call it. If large scale experiments are carried out in the manner prescribed by the instructions of the NESWA Committee, much of the misinformation and misapprehension concerning sewage sludge will be eliminated in the minds of the public.

Warren Scott, Chief Engr., Connecticut Dept. of Health, reported as the representative of the New England State Sanitary Engineers on the matter of Federal legislation on stream pollution control. Mr. Scott discussed briefly the provision of the new Mansfield Bill H. R. 6024 and pointed out the three sections to which the New England State Sanitary Engineers object, namely, those sections which limit state control and lodge complete control of the problem with the Federal Government. No action was taken at the meeting but Mr. Scott was requested to prepare a report for submission to the Executive Committee of the Association for its formal action at its next meeting.

CONTROL OF SCUM IN SLUDGE DIGESTION

(A Symposium)

When it comes to topics for a symposium, program chairmen can be assured of an interested audience if the subject is scum in digestion tanks. New England doesn't have all of the scum in digestion tanks but it has its share. Hence the devoting of the entire program of the meeting to this subject proved to be popular.

Leading off the discussion was **Paul Cerny,** Eastern Representative of the Pacific Flush Tank Co., who presented a paper for Harry E. Schlenz, Vice President of the company. According to Mr. Schlenz' paper, types of scum encountered in digesters may be divided into two classes: non-digestible accumulations and digestible accumulations.

In the former class are seeds, match sticks, etc., industrial wastes typified by hair, and unsaponifiable greases such as mineral oils. In the latter class are gas lifted solids, saponifiable fats (and soaps), and solids buoyed by adherence to grease particles.

General characteristics of scum with which operators have to deal may be summed up as follows: high in volatile matter content (70 to 90 per cent); high in percentage of fats and soaps; low in moisture content (up to 25 per cent dry solids).

Committee Reports

Salaries
Thos. R. Camp
Cons. Engr.
Boston, Mass.

Fertilizer
J. Henry Giles
State Dept. Health
Hartford, Conn.

Although many operators hesitate to add scum or grease from sedimentation tank skimmings to digesters, actually the digester is the best

Programmers

Paul J. Cerny
Pacific Flush Tank Co.
New York

Jos. J. Gilbert
Link-Belt Co.
Philadelphia, Pa.

place to dispose of the material as long as it is digestible, for contrary to opinions of a number of years ago, grease is readily digestible, yielding a high methane content gas. As long as scum in digesters does not build up to depths of more than a foot or so it does not interfere with the operation of digestion tanks.

This being the case, it is obvious that if proper conditions are provided in the scum mass, it is possible to promote the digestion of the material and control scum formation.

Control of scum may be accomplished in three ways: liquid saturation, control of temperature in scum zone, and ammonia nitrogen control.

Liquid Saturation of Scum. Scum may be saturated with liquid by positive submergence by an impervious structure of the materials which tend to float, thereby keeping the solids from drying out with gas. Another method of liquid saturation is to circulate supernatant liquor from below the scum layer to the top of the layer. It is not necessary, nor is it desirable to circulate this liquor to the top of the scum with any jetting force. Best results are accomplished by discharging the liquid over the surface of the scum at the central part of the tank in the gas dome. The rate of discharge should be such that the upper two-thirds of the digestion tank volume is recirculated in 24 to 48 hours.

Control of Temperatures in Scum Zone. Scum layers are usually lower in temperature than the body of the digesting sludge. If brought to normal temperature, digestion proceeds at a better rate and scum formations decrease. This increase in temperature of the scum layer may be brought about by recirculation (as above) or by applying an external source of heat to the scum layer.

Ammonia-Nitrogen Control. Plant scale experiments have shown that heavy scum formations may be softened by the addition of ammonium sulfate, in relatively small amounts, to the scum concentration. This ammonium sulfate added in amounts of 50 to 100 lb. as a concentrated solution actually causes a softening of the scum and an increased digestive activity with increased gas production. If added at too rapid a rate, foaming may be caused. One plant which uses this treatment regularly adds approximately 100 lb. whenever scum accumulations become excessive, about once every three months.

As yet no adequate explanation of the effect of ammonium sulfate on scum dissipation is available, but it is possible that the scum zone is deficient in ammonia nitrogen, a condition which may not always be corrected by recirculation.

Programmers

R. S. Rankin
The Dorr Co.
New York

Joseph Doman
Supt. Sew. Treat.
Greenwich, Conn.

Mechanical Scum Breaking

With the aid of slides, **Joseph J. Gilbert,** Engineer, Link-Belt Co., Philadelphia, presented a story on the use of mechanical scum breakers and their efficacy under various conditions.

Studies have indicated that mechanical breaking of scum does not produce any more gas per pound of volatile matter digested, but any digestion of scum will increase the amount of gas per capita.

Scum breakers are excellent where the scum is of a fibrous nature, such as hair from a felting plant. Mr. Gilbert showed several installations where this type of scum breaker was working satisfactorily, including a plant at Danbury, Conn.

Contrary to some opinions expressed in the past, mechanical scum breaking equipment does not either cause explosions or contribute to conditions which cause explosions.

Mr. Gilbert showed pictures and designs of a new sludge digester of the Link-Belt Co., in which a method is available to draw off supernatant liquor relatively free of solids. Special sludge drawoffs also are available, and the tanks are equipped with mechanical scum breakers. These devices can be used in circular as well as longitudinal tanks.

Summing up his comments, Mr. Gilbert said that mechanical equipment is not needed to improve digestion but does aid in the mixing of the materials in the tank; mechanical equipment is required to break up scum; scum breakers are desirable; and there are many designs available both here and abroad.

Scum Problems

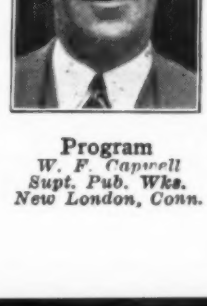
R. S. Rankin, Manager, Sanitary Engineering Division, The Dorr Co., reviewed the characteristics of scum in digesters, listing five types of scum: grease and oils, industrial plant fibres, miscellaneous indigestible materials, gas buoyed sludge, and combinations of these.

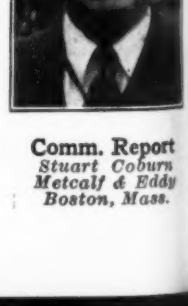
For scums of the first type, Mr. Rankin suggests the use of heat to relieve the condition. Temperatures of 95 deg. F. should soften the grease and allow bacteria to penetrate it.

Industrial plant waste fibres should be kept out of sewers and treatment plants. Miscellaneous scum-forming materials should be removed from the digester at intervals as necessary.

To prevent scum from gas buoyed particles, the best method is to provide sufficient mixing to effect a scrubbing action of the particles, releasing entrained gas and allowing the particles to sink.

The construction of the digester has a bearing on scum formation. Where the roof of the digester allows gas above the surface of the digester contents (i.e., no submergence) the scum can best be handled by submerging it with some form of surface agitation. Where the roof provides submergence, the use of slow moving scum breaking equipment is recommended.





Program
W. F. Capwell
Supt. Pub. Wks.
New London, Conn.

Comm. Report
Stuart Coburn
Metcalf & Eddy
Boston, Mass.

Seen On The Inspection Trip

R. S. Burr
Amer. Brass Co.
Waterbury, Conn.

F. L. Flood
Metcalf & Eddy
Boston, Mass.

L. Van Kleek
Dept. of Health
Hartford, Conn.

Wm. E. Stanley
Prof., Civil Engrg.
Mass. Inst. Tech.

In summarizing Mr. Rankin said, "The best way to avoid major scum problems is to attempt to eliminate the cause. Where this ideal cannot be wholly accomplished, it appears . . . that effective scum treatment, including digestion of all that is digestible, and the ultimate removal with the digested sludge can be secured by intensive agitation of a free surface in the digester.

Other Treatments

In the absence of **L. H. Chamberlin**, W. F. Monroe, of Builders-Providence Co., read the paper prepared by Mr. Chamberlin, who proposed that one of the best schemes for preventing scum formation is to keep the grease out of the digesters, skimming it off of the sedimentation tanks for sale if possible. Mr. Chamberlin also suggested the recirculation of sludge from the sludge digestion zone to the scum surface, and cited installations where this treatment is employed. Another unusual method proposed by Mr. Chamberlin is to pump cold sewage into the scum, causing it to congeal, become more dense, and settle.

Experience at Greenwich

Greenwich, Conn., has experienced scum troubles, too, according to **Joseph Doman**, San. Engr., Dept. of Pub. Works, who told of scum layers 12 feet thick, and of how recirculation of supernatant liquor had helped to relieve the condition. One of the most troublesome elements in the scum at Greenwich was the raw solids in the scum. Compaction and rubbery condition of the scum likewise have caused trouble. To eliminate some of the difficulties, the raw sludge is pumped into the digesters in the morning and the recirculation of supernatant liquor is carried out in the afternoon. This schedule prevents the collection of raw sewage solids in the scum.

The most ingenious thing about Mr. Doman's operations of the Grass Island plant is his method for determining the location of the various zones, sludge, liquor, and scum. Six sampling drawoff pipes are available on the digester, but these are spaced at 3½ to 4 ft. intervals and samples therefrom do not give a true picture of conditions in the tank.

To obtain a more nearly accurate location of distribution of the various layers, Mr. Doman uses the following technic. Samples are collected from the sampling ports and allowed to settle in a tube for a period of ten minutes. The settled solids volume is then read off and converted into per cent by volume. Then by use of two curves (the sludge line interpolator and the scum line interpolator), which can be placed alongside a chart showing the elevations in the tank and the location of the sampling points, Mr. Doman can read off the elevation at which the scum line or sludge line is located. Although these curves are purely empirical developments, they do give information of great use to the operator.

Camp Myles Standish

Although the grease was kept out of the sewage treatment plant at Camp Myles Standish, Taunton, Mass., the digesters still had a large quota of scum problems, according to **Robert M. Donnelly**, Sanitary Engineer of the camp. After considerable trouble, it was found that emptying the tank and removing the scum by hand was the only sure way to control it. It is now a regular procedure once each year.

Naval Depot

Ernest D. Mortenson, Chief Engineer of the Naval Depot at Davisville, R. I., had had some rather harrowing experiences with scum in digesters. The floating covers were tilted and bound, and it was necessary to use fire hoses to break up the scum. Thereafter, it was found that by increasing the temperature up to 100 to 105 deg. F. and by recirculating supernatant liquor, the scum conditions were controlled; in fact, the scum layer was actually reduced from seven to five feet.

The Federation

Representing the Federation of Sewage Works Associations, **Francis S. Friel**, Vice President of the Federation, spoke at the luncheon, telling the assembled members and guests about "Federation Affairs," and plans for the future, including the annual convention to be held in Toronto, Canada, in October.

Stressing the need for a better public acceptance of the role of the sewage plant operator and the importance of his work, Mr. Friel pointed out that whereas one man working two weeks could design a $100,000 mill building, it takes three men two months to design a sewage treatment plant costing the same amount.

Inspection Trip

The afternoon activities were given over to an Inspection Trip to the Grass Island and Stamford Sewage Disposal Plants. The superintendents of the respective plants acted as guides on the tour. A flow diagram of the Grass Island Plant is shown herewith.

INSTRUCTIONS FOR THE CONDUCTING OF SEWAGE SLUDGE FIELD TESTS

(Prepared by the Dept. of Soils, Conn. Agricultural Experiment Station, in cooperation with the Committee on Sludge Utilization as Fertilizer, NESWA.)

Scenes On Inspection Trip

Field experimentation involves the applying of sludge to relatively small, measured areas of land called plots. The size and shape of the plots depend on the crop, the size and shape of the fields, the amount of labor available, etc. Plots may vary from 15 or 20 sq. ft. in a garden to one-half acre or more in large fields. The main requirement is that the plots be of such size and shape that application of the treatment, and planting, cultivating, and harvesting of the crop can be done uniformly and without undue interference with the regular farm practices; and yields of the various plots obtained accurately, without confusion and without an excessive amount of labor.

Principles of Field Experimentation

1. The land should be reasonably uniform as to soil and topography, and preferably level or nearly level.

2. Each set of plots must have one plot without sludge (i.e. a check plot).

3. Use several rates of application if possible.

4. Run each experiment in duplicate or triplicate *with the same crop.*

5. All plots in a set must be treated exactly alike, aside from the sludge treatment; i.e. plowing, fertilizing, seeding, spraying, watering (if practiced), harvesting, etc. should be done at the same time, at the same rate, and in the same manner on all plots.

6. Observe results the second and third years, if possible. In some cases, sludge may be added every year. In others, every 2nd year, or once in 3 years, depending on the crop and the soil.

Specific Instructions

1. *Sludge treatments.* Use 0, 12½, 25 and 50 cu. yds. per acre or approximately 0, 7, 14, and 28 bu. per 1000 sq. ft. If only one rate, choose 0 and 25 yds. per acre or 0 and 14 bu. per 1000 sq. ft. The moisture content of dewatered sludge usually runs 60 to 70 per cent (150 to 230 per cent water-free basis).

2. *Commercial fertilizer.* Whether or not to use fertilizer along with sludge depends on the crop and on the farming practices usually followed. Ideally it would be better to run two series, one with fertilizer and sludge, and one with sludge alone. Probably in most instances a moderate amount of commercial fertilizer will be desirable, which should be applied equally to *all* plots including the check.

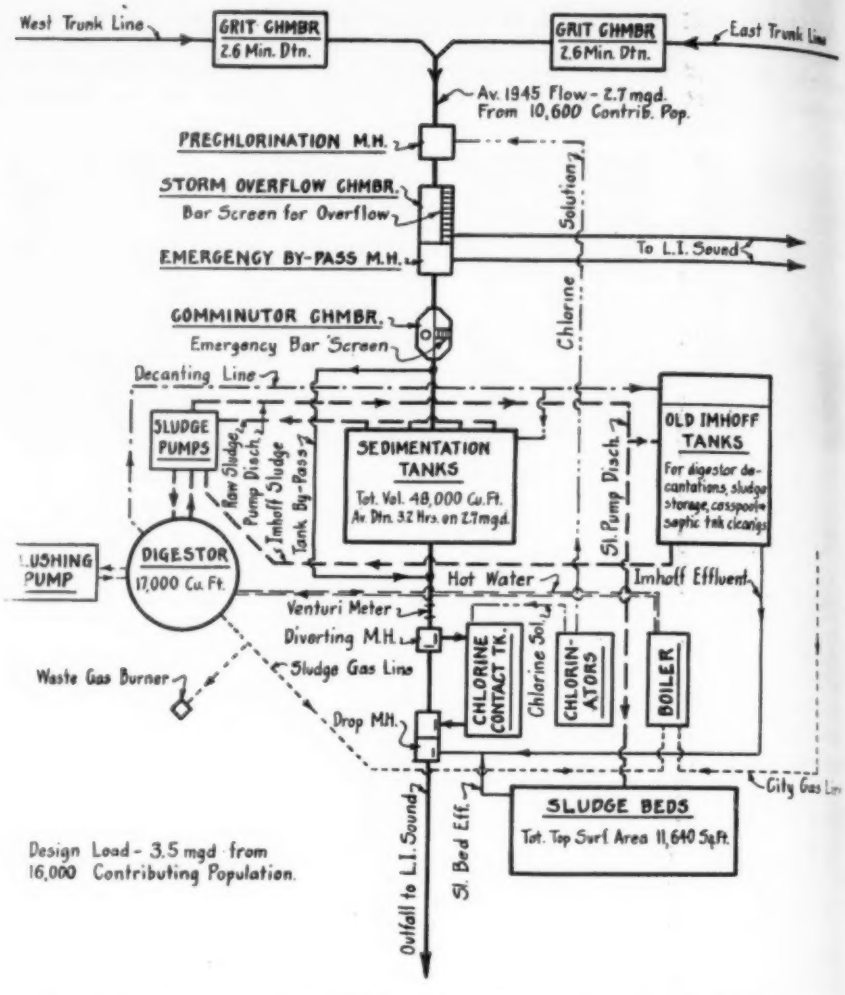
Since sludge contains practically no potash, a high potash fertilizer is desired, especially for potatoes, beets, and other root crops. If the usual rate without manure or sludge is 2000 lb. of 5-10-10 per acre, use 600 lb. of 8-12-20 or 8-12-16, or 900 lb. of 5-10-10.

3. *Plot design.* For corn, potatoes and other row crops, the plots should be wide enough to include not less than 4 rows which should extend all the way across the field, if possible, to facilitate farming operations. Obtain yields on the inside rows only.

For hay, pasture and other non-row crops, plots should be not less than 12 feet wide, and extend across the field. In taking yields, first cut out the border strips, if possible, and measure only the center portion. Or one may mark off 2 or more sq. yds. in the center portion on which the crop will be carefully weighed or measured.

When differences are readily apparent to the eye, photographs are valuable in recording same. Always include a person, a yard stick, a standard tool or some other object for comparison of size; and in all cases have the camera at the same distance from the plants.

4. *Assistance.* The County Agent or someone from the Experiment Station should be consulted before the work is actually started, occasionally during the season and especially at harvest time.



Flow Diagram—Grass Island Sewage Treatment Plant—Greenwich, Conn.

Malcolm Pirnie Forms Partnership with Associates

Malcolm Pirnie has announced the formation of a partnership with his associates: Ernest W. Whitlock, G. G. Werner, Jr., Robert W. Sawyer, and Richard Hazen. The firm will continue its engineering practice under the name of Malcolm Pirnie Engineers, at 23 West 43rd St., New York City.

The Chester Engineers Admit New Partners

Messrs. John T. Campbell and Daniel E. Davis have announced the admittance to partnership of Edw. T. Davis, H. F. Lundberg, T. R. Haseltine and C. K. Stark. E. F. Bankson has resigned from the firm. The Chester Engineers are located at 210 E. Park Way, Pittsburgh, Pa.

Colorado Towns to End Pollution

Among the many municipalities throughout the country which are planning sewage disposal treatment are 14 Colorado towns who were notified last year of unsafe conditions. This announcement of action was made by Dr. Roy L. Cleere, secretary and executive officer of the Colorado State Board of Health.

THE DETERMINATION OF SUSPENDED SOLIDS WITH GLASS CRUCIBLES

A Study Comparing Sintered Glass Crucibles and the Standard Gooch Filter

By R. W. SIMPSON*
Sanitary Engineer
KEESLER FIELD, MISS.

and

J. A. ALEXANDER, PFC.
Sewage Plant Chemist
KEESLER FIELD, MISS.

THE present method of determining suspended solids in sewage, as described in Standard Methods,[1] has several inherent weaknesses, the most important of which is the preparation of the asbestos mat in the Gooch crucible. Regardless of the care exercised, it is difficult to prepare two crucibles with the same mat retention. Some of the problems involved are uniform suspension of asbestos, occurrence of pin holes, variation in mat thickness and packing, and washing through of small fibers. Since there are so many variables in the preparation of the asbestos filter mat, it was thought feasible to search for a method of standardizing the filter medium.

TABLE I

Comparison Between Duplicate Gooches

Test Number	Suspended Solids—ppm. Gooch No. 1	Gooch No. 2	ppm. Difference Between Two Samples	Per Cent Deviation of Either Sample from Mean
1.....	26	33	7	12.1
2.....	12	15	3	11.5
3.....	14	21	7	20.0
4.....	12	14	2	7.7
5.....	22	15	7	19.0
6.....	18	20	2	5.3
7.....	16	20	4	11.0
8.....	12	16	4	14.3
9.....	16	13	3	10.2
10.....	14	10	4	15.2
11.....	25	26	1	2.0
12.....	27	31	4	6.9
13.....	30	37	7	10.2
14.....	35	35	0	0.0
Avg..	19.9	22.5	2.6	10.4

The use of sintered glass crucibles, was considered. For this work, Corning Glass Co. supplied samples of fine, medium, and coarse porosity crucibles to be used in the investigation.

Procedure

In the preparation of Gooch crucibles, the following method was used: approximately 35 ml. of well shaken asbestos suspension (2.5 grams of medium acid-washed asbestos in 900 ml. of distilled water) was poured into the Gooch crucible and suction applied; the resulting mat was washed and set with approximately 35 ml. of distilled water; then dried at 103° C. and weighed to 0.001g.

R. W. Simpson

Inasmuch as the glass crucibles needed no mat, the only preparation necessary was thorough cleaning. The method used for this was to fill the crucible one-third to one-half full with chromic acid cleaning solution, then apply suction until the latter saturated the porous glass and just started to leak through. The crucible was then allowed to stand for about 10 minutes, the excess solution poured out and the crucible thoroughly washed by drawing distilled water through it under vacuum. The porous glass is translucent and may be inspected by observing a bright light through it. After cleaning, the crucible was dried at 103° C., weighed and ready for use.

Samples of sewage plant effluent were used in the test. Each sample was shaken thoroughly twenty-five (25) times and simultaneously duplicate 100 ml. portions were poured into volumetric flasks. The measured samples were then filtered through the crucibles.

Results

In order to compare the results obtained using the glass crucible and the standard Gooch filter, it was first necessary to establish the accuracy of the Gooch method. For this reason, a series of duplicate tests was run on a number of samples. The results shown in Table I indicate that duplicate samples will deviate from the mean by approximately 10 per cent, and this deviation may vary from 0 to 20 per cent.

The first comparison using glass crucibles was made between the standard Gooch crucible and a glass crucible with a fine porosity filter disc. These results are shown in Table II-A. Although only a few results are available, they clearly indicate that there was little agreement between results obtained with the

TABLE II

Comparison Between Standard Gooch Crucible and Glass Crucible

A. With Fine Porosity Disc

Test Number	Suspended Solids—ppm. Standard Gooch No. 1	Glass Crucible Fine Porosity No. 2	Ppm. Diff. No. 1-No. 2	% Dev. from Gooch
1.....	29	27	2	— 6.9
2.....	27	33	— 6	+ 22.3
3.....	35	34	1	— 2.9
4.....	30	33	— 3	+ 10.0
5.....	38	94	—56	+147.0
6.....	26	39	—13	+ 50.0
Avg..	30.9	43.3	..	...

B. With Medium Porosity Disc

1.....	30	26	4	— 13.4
2.....	29	21	8	— 27.5
3.....	33	23	10	— 30.3
4.....	31	26	5	— 6.2
5.....	16	13	3	— 18.8
6.....	30	32	— 2	+ 6.7
7.....	16	14	2	— 12.8
8.....	38	36	2	— 5.3
9.....	16	17	— 1	+ 6.3
10.....	22	26	— 4	+ 18.2
Avg..	26.1	23.4	2.7	— 10.2

C. With Coarse Porosity Disc

1.....	27	17	10	— 37.2
2.....	10	14	— 4	+ 40.0
3.....	45	24	21	— 46.7
4.....	38	22	16	— 42.3
5.....	27	15	12	— 44.6
6.....	25	18	7	— 28.0
7.....	27	15	12	— 44.6
8.....	31	21	10	— 32.2
9.....	32	25	7	— 28.0
10.....	8	22	—14	+176.0
11.....	12	12	0	0.0
12.....	26	31	— 5	+ 19.6
13.....	14	15	— 5	+ 19.6
14.....	12	15	— 3	+ 25.0
15.....	18	17	1	+ 5.6
16.....	16	16	0	0.0
17.....	12	16	— 4	+ 33.3
18.....	16	15	1	— 6.3
19.....	14	9	5	— 6.3
20.....	25	13	12	— 48.0
21.....	27	14	13	— 48.0
22.....	33	18	15	— 45.5
23.....	31	17	14	— 45.0
24.....	16	10	6	— 37.6
25.....	30	14	16	— 53.0
26.....	16	9	7	— 44.0
27.....	38	22	16	— 42.1
28.....	16	10	6	— 37.6
29.....	22	13	9	— 41.0
Avg..	22.9	16.5	6.4	— 28.0

*Now Sanitary Engineer, Gilbert Associates, Inc., Reading, Pa.

two crucibles. With the glass crucible, an excessively long period of time was required to filter the sample. For this reason the fine porosity glass crucible was discarded immediately as unsatisfactory.

A comparison was then made between a Gooch crucible and a glass crucible with medium porosity disc. Results using this type crucible are shown in Table II-B. These results indicate that the deviation between the glass crucible and the Gooch crucible amounted to approximately 10 per cent. Since the correlation between the glass crucible, with medium porosity disc, and the standard Gooch was comparable to the correlation between duplicate Gooches, it may be assumed the results obtained using this type crucible will be comparable to results using the standard Gooch crucible, for sewage effluent analysis.

The pore size of the filter disc in the glass crucible is controlled during manufacture, producing filter discs which are standard. For this reason, results obtained from day to day should be comparable, at the same time eliminating errors due to asbestos mat preparation.

A comparison was next made between a standard Gooch crucible and a glass crucible with a coarse porosity disc. These results, shown in Table II-C, indicate that less suspended material was being retained on the glass disc than on the asbestos mat, and the deviation was more than twice as much as that between two Gooch crucibles.

Conclusions

1. Results of this preliminary investigation confirm other studies showing that the standard Gooch crucible used in the determination of suspended solids is subject to considerable error. Further research is necessary to standardize the Gooch method.

2. The use of sintered porous disc glass crucibles with constant and standard porous glass discs will eliminate one of the variables encountered in the present method.

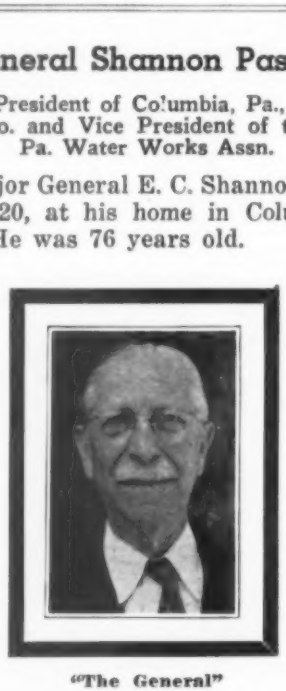
3. For the analysis of sewage plant effluents, preliminary data indicate that a porous glass disc of medium porosity will give results comparable to those obtained by the Gooch crucible method, but neither fine porosity nor coarse porosity discs are desirable.

4. These preliminary results also indicate that further study on the use of a medium porosity glass disc crucible may be warranted. Such a study should certainly include the collection of a large amount of data on the accuracy of the Gooch crucible method as well as a comparison of the two crucibles, and the data should be collected on weak and strong raw sewage as well as sewage works effluents.

General Shannon Passes

Was President of Columbia, Pa., Water Co. and Vice President of the Pa. Water Works Assn.

Major General E. C. Shannon died May 20, at his home in Columbia, Pa. He was 76 years old.



"The General"

A native of Phoenixville, Pa., his first job was that of chemist and he was later superintendent of a blast furnace. He went to Columbia, Pa., as manager of a textile plant, became interested in the Columbia Water Co., and eventually became its president.

The General's military career dates back to 1889, when he joined up with the Pennsylvania National Guard as a buck private. In the Spanish-American war he became a captain and in the Mexican border incident of 1916 he was colonel of Pennsylvania troops and served with the same rank through World War I, and was awarded the Distinguished Service Medal for exceptional gallantry in the toughest of the French engagements. After World War I he was made Brigadier General in command of the 56th Cavalry Brigade. In 1933 he was made Major General and commanding officer of the National Guard of Pennsylvania, retiring in 1939, after 50 years of distinguished military service.

"The General," as all knew him, was active in the civic life of Columbia and Lancaster County and was an ardent Rotarian, Lancaster County Chamber of Commerce leader, and a staunch Presbyterian. He was a member of numerous fraternal orders and a Knight Templar in Masonry.

The General was active in the affairs of the Pennsylvania Water Works Association up to the time of his death, when he was serving as a vice-president of the association. "Once a water-works man, always a water-works man"—and the General exemplified this saying.

Stanley Resumes Engineering Practice

Served as Colonel in Army Air Forces

Col. Arthur E. Stanley has returned to Muscatine, Iowa, to resume his partnership with the Stanley Engineering Co., after five years of service with the Army Air Forces. During this period, Colonel Stanley spent two and a half years in charge of building and ground department of the Army Air Forces Western Flying Training Command, and two years as the AAF representative and termination contracting officer at the Consolidated Vultee Aircraft Corp. at San Diego, Calif.

Canton, Ohio, To Have Dual Disposal

Activated Sludge Plant to Include Garbage Grinding

The city of Canton, Ohio, has approved the construction of an activated sludge plant which is to include garbage grinding and digestion as an integral part of itself.

Alvord, Burdick, and Howson, Consulting Engineers, of Chicago, were retained by the municipality to study the project, and after they presented a report on sewage disposal with and without garbage grinding, the city council adopted the plan to include the garbage grinding feature.

A site for the new plant has been selected and the city council has passed a sewer revenue ordinance to finance the construction and operation of the project. It is expected that the work will go forward immediately. When the project is completed, it will provide not only for complete sewage treatment but for garbage grinding for the present population of 125,000 in lieu of the present disposal of garbage by hog feeding. In the new plant the garbage will be ground at the sewage treatment plant and discharged directly to the digesters.

ACTIVITIES OF THE NATIONAL COUNCIL FOR STREAM IMPROVEMENT, INC.

By HARRY W. GEHM, Ph.D.
Technical Adviser*
NEW YORK CITY

THE National Council, incorporated in the State of Delaware, is a non-profit-making corporation and is autonomous and entirely independent of any other association or organization. Under the By-Laws, executive control is vested in a Board of Governors elected annually by the membership, with representation proportional to the dollar value of dues paid by groups of members manufacturing various products. The purpose of this organization is to conduct research directed toward the treatment, abatement, recovery and utilization of liquid wastes resulting from the manufacture of pulp, paper, and paperboard, and to assist its members in the application of the techniques developed through its research activities to mill operations. The above briefly summarizes the organization, functioning and earlier activities of the Council which began active operations in June 1944.

The Author

With the present widespread interest in stream pollution abatement and Federal legislation on the subject receiving considerable attention, we believe our readers would like to know what is being done on at least one of the major stream pollution problems. We have therefore asked Dr. Gehm to outline the work being done on the various wastes from the paper, pulp, and paperboard industries.

At the present time the Council's membership represents roughly 85 per cent of the total pulp, paper, and paperboard production of the United States. The Council will operate during 1946 on a budget of approximately $140,000, all of which, with the exception of minimum overhead and executive office personnel expense, will be spent for research. At this point it may be of interest to point out that the pulp, paper, and paperboard industry is currently spending over a quarter of a million dollars on cooperative research devoted to developing a solution to the industry's waste disposal and utilization problems. In addition to the funds being spent on cooperative research, individual

*National Council for Stream Improvement Inc.

Pilot Plant for the Treatment of Strawboard Waste, Terre Haute, Ind.
A Permutit precipitator and a high rate trickling filter comprise the main units of the plant.

Personnel Devoting Efforts to Solving Paper Waste Problems

Seated, left to right: Dr. Harry W. Gehm, Technical Advisor, National Council; Dr. Willem Rudolfs, Chief, Dept. Sanitary Engr., Rutgers University; Russell Winget, Exec. Secy. National Council; Dr. G. W. McCready, Prof. Chem. Engr., Univ. of Michigan; Dr. Willis M. Van Horn, Aquatic Biologist, Inst. of Paper Chemistry; Dr. George D. Beal, Asst. Dir., Mellon Inst. of Ind. Research; J. M. Holderby, Co-ordinator, Sulfite Wast Proj., Inst. Paper Chemistry.

Standing, left to right: Dr. Walter Lawrence, Prof. Chemistry, Bates Univ.; Dr. W. W. Hodge, Sr. Fellow, Mellon Inst. Ind. Research; Prof. Don E. Bloodgood, Prof. San. Engr., Purdue Univ.; Dr. G. M. Ridenour, Resident Lecturer, Inst. Pub. Health, Univ. of Mich.; Prof. C. J. Velz, Head, Dept. of Civil Engr., Manhattan College; Philip Morgan, Non-resident Fellow, Mellon Inst. of Ind. Research.; William A. Moggio, Field Engr., Nat. Council.

companies are probably spending an equal or greater amount.

The Council's administrative staff, operating from the central office at 271 Madison Avenue, New York City, are Russell L. Winget, Executive Secretary, and Dr. Harry W. Gehm, Technical Advisor.

After approximately two years of active functioning the Council has organized what is believed to be a sound research program. A definite procedure has been established for referring problems to the attention of the research groups. Standing regional committees have been organized in each of the seven regions of the United States. These committees meet twice a year and, based on information obtained through distribution of questionnaires and from personal knowledge of the committee members, the urgent problems in the region are presented for consideration in open meeting. Such presentation generally results in a recommendation to the Board of Governors and in the establishment of a research program at a qualified institution contiguous to the area in which the particular problem is concentrated. As a result of the recommendations of the regional committees seven separate research investigations are now under way. These include the projects (to be discussed later) which are now fully organized and on which the laboratory and field work is progressing rapidly.

Policies

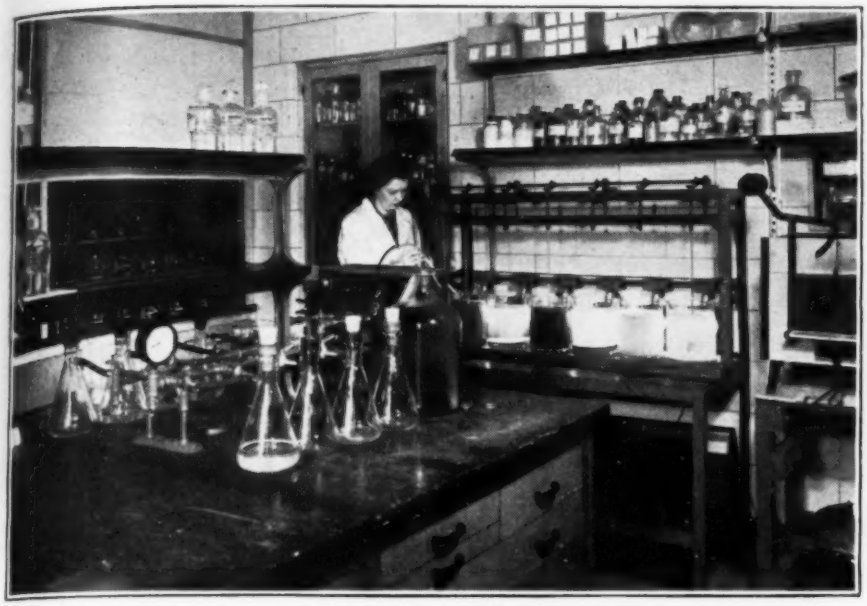
Before reviewing the Council's various research activities it would be of interest to outline some of the policies adopted by the Board of Governors so far during the organization's existence.

First among such policies is the decision relating to the direction and emphasis of the research program. While the research program is two-fold, namely, abatement and utilization, the Board of Governors has ruled that the primary efforts at this time should be devoted to abatement activities as it is felt that abatement cannot wait on the development of utilizable materials to pay the cost of treatment. This policy derives from the necessity of remedying the pollution situation in so far as it is affected by the industry, and in view of the public consciousness of stream pollution problems as evidenced by the demands for national and state legislation the policy is obviously sound. This does not mean that the recovery of usable material is being overlooked but rather that the emphasis at this time must be on stream improvement.

Second is the policy of nonintervention in political matters, particularly legislation. The Council familiarizes itself with pending legislation so that the various research activities may be properly oriented to the probable demands of enacted legislation. The Council will not, however, attempt to direct the support or opposition of the industry in legislative matters.

Third is the matter of cooperation with regulatory agencies. The Council is making every effort to cooperate with national, state and other regulatory agencies having jurisdiction in stream pollution. Such agencies are regularly invited to attend regional committee meetings; they receive Council releases and their representatives are welcomed at the various research laboratories to examine results achieved and to consult with and advise the research staffs. The Council has been very successful in securing the helpful cooperation of these regulatory agencies and the cooperative relationship thus established has resulted in benefit not only to the industry but to the agencies themselves.

In respect to the use of waters for the disposal of wastes, the Council subscribes to the policy adopted by most of the outstanding authorities in the field of stream sanitation. This "reasonable use" policy is based on the concept that an industry or municipality is entitled to use the stream for the disposal of wastes providing that such use is not contrary to the public interest, does not constitute a public nuisance,



Portion of Laboratory at Mellon Institute
Miss Gladys Swope conducting experiments on de-inking waste

or menace the public health, deprive downstream industries of their right to a usable supply of water and, in general, does not prevent the use of the streams for the purpose to which they are normally put.

The equities involved in the industrial usages of water are of great importance and are recognized by our policy. Industry uses vast quantities of water in various manufacturing processes. In this respect one of the early conclusions drawn from one research project was that if nothing else could be salvaged or recovered from the mills' effluent, at least water could be made available for reuse.

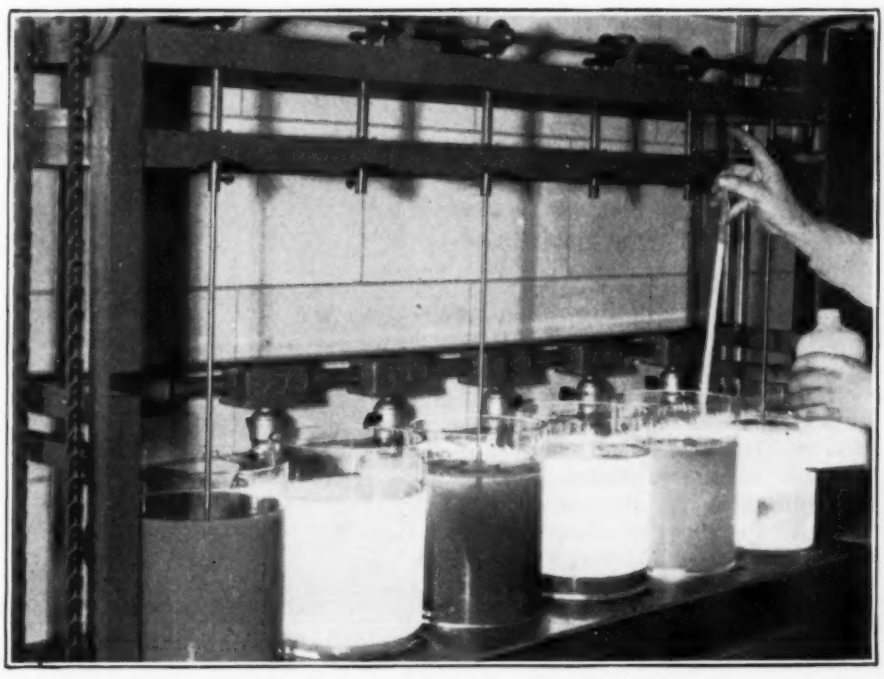
Research Program

At the inception of the Council's research program, those charged with its organizaton realized that the institution of laboratory research alone would not provide the results in stream improvement which would lead to success in achieving the necessary objectives. With this in mind, facilities were provided whereby both general and specific problems in assembled form and designated as to relative urgency and importance were brought to the attention of the respective qualified research laboratories selected for the various studies. Into the assembling of the problems went all the available knowledge on the various subjects gleaned from the literature and company reports. Together with this information, technical men of the manufacturers, regulatory agencies, and universities were consulted to obtain their thoughts and ideas as to how the problems should be approached.

Through the central office, key research workers are kept in continuous contact with mills working independently on similar problems in order to avoid duplication of effort and so that the research personnel can evaluate properly their progress in terms of actual mill application. It was also appreciated that the results of laboratory research are not always in suitable form for direct application and that further development through pilot plant and demonstration units must be conducted before full scale use can be made of the findings. With this in mind means have been provided whereby the Council can carry through complete development of waste treatment processes with the cooperation of mills to the point where they are ready for full scale application.

De-inking Wastes

A year and a half ago the Council established a multiple fellowship at the Mellon Institute of Industrial Research at Pittsburgh to investigate phases of the waste problem suitable for laboratory investigation and of particular interest to the mills in the Pennsylvania area. Dr. W. W. Hodge is in direct charge of the project on which a sanitary engineer, sanitary chemist, a chemical engineer, and two assistants have been employed. The major investigations carried on to date have dealt with de-inking waste, semi-chemical waste and bleach liquors. Major attention has been directed to the treatment of de-inking waste and considerable progress has been made. Coordinated with the laboratory investigations for almost a year, Philip Morgan, the project's sanitary engineer, has been carrying on field studies in the Kalamazoo area, in which a concentration of mills carrying on de-inking operations exists. Kalamazoo College has cooperated with the Council in supplying laboratory facilities and personnel. The University of Michigan has assisted in the work on a consulting basis; Dr. G. M. Ridenour and Dr. D. W. McCready advising



Coagulation Experiments on De-inking Wastes

Stream Aeration for Waste Sulphite Treatment

Aeration plates ready for installation in tail race of power plant. *Air bubble pattern from aeration plates installed for stream aeration.*

on stream pollution and manufacturing aspects of the problem respectively.

A four phase attack is proceeding along the following lines:

1. Laboratory investigations to determine physical and chemical characteristics of the waste and the relative efficiency of various proposed processes of treatment and the development of new methods.

2. Mill studies involving the determination of the volume and character of individual discharges from unit processes for the purpose of determining if the volume of waste can be reduced or segregations made which would facilitate treatment.

3. Studies on the reaction of de-inking wastes and various components thereof in a receiving stream.

4. Methods for the recovery and disposal of the sludge produced by treatment.

The Michigan Stream Control Commission represented by Messrs. Milton Adams and Loring Oeming are assisting in the stream studies. Progress made to date has opened some promising new approaches which are being followed.

Analysis of Watersheds

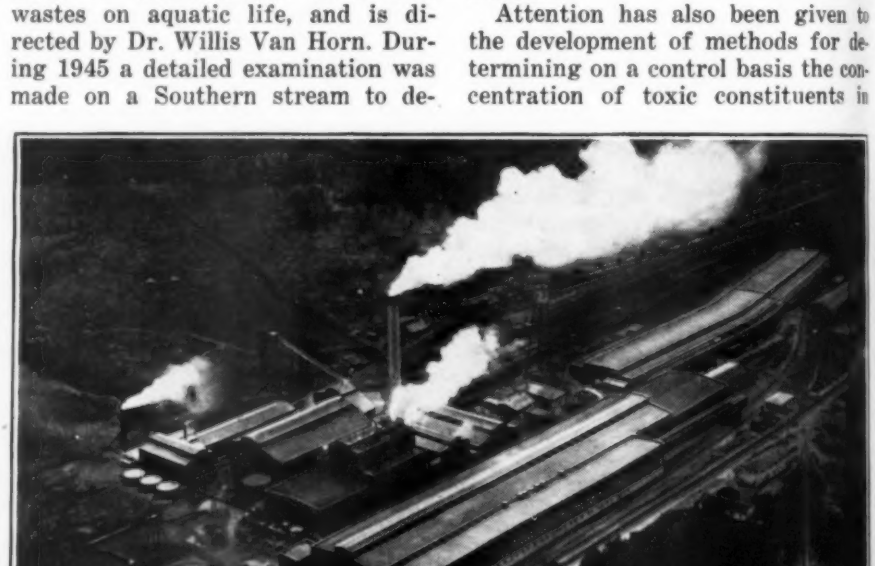
At Manhattan College, Professor Clarence Velz, Head of the Civil Engineering Department, is making a sanitary analysis of all the watersheds of the United States, in which the pulp and paper industry is situated. The purpose of the survey is to determine the industry's responsibility for existing stream conditions in relation to other industries and municipalities and also to determine the degree of treatment the pulp and paper industry's wastes must receive to be rendered acceptable for discharge into the stream. Professor Velz is a national authority in the field of stream analysis calculations and has a staff of four part-time civil and student engineers.

Aquatic Biology Project

At the Institute of Paper Chemistry the National Council has established an aquatic biology project the purpose of which is to investigate the effect of pulp and paper mill waste on aquatic life. This research has the background of several years' work on the effect of kraft mill wastes on aquatic life, and is directed by Dr. Willis Van Horn. During 1945 a detailed examination was made on a Southern stream to determine whether or not certain dilutions of kraft mill waste had deterrent effect on migratory fish. A comprehensive report covering this work has gone forward to the member mills.

The present phase of the work currently being carried on at Appleton, Wisconsin, deals with the effect of pulp and paper mill effluents on plankton organisms upon which fish feed. These are a part of the biological change necessary for the propagation of fish in any body of water; hence, they must be maintained if desirable conditions are to exist. This project will be completed this summer.

Attention has also been given to the development of methods for determining on a control basis the concentration of toxic constituents in



Typical Kraft Paper Mill

Note at far left, settling basin and lagoon through which all waste is discharged at controlled rate.

mill effluents. The knowledge of such methods would be of considerable value to kraft mills troubled with periodic toxic effluent resulting from operational abnormalities.

During the late summer this project will be extended to include studies on the toxicity of kraft mill waste to salmon and other fish in the West Coast area. Since different species of fish, water conditions, and wood wastes exist it will be necessary to establish first toxicity levels under these conditions as have been established in other parts of the country.

The aquatic biology project has been established on a continuing basis; hence it will be in a position to take up new problems as those now under study are completed.

Waste Sulphite Liquor Disposal

The Council has undertaken three projects in connection with waste sulphite liquor disposal. These are the trickling filter, river aeration and fodder yeast projects. The first two of these activities are centered at Wisconsin mills and at the Institute of Paper Chemistry and the third is at Oregon State College.

In the trickling filter process, waste sulphite liquor is treated and the biochemical oxygen demand is satisfied before the waste liquor passes into the receiving waters. This project has passed from the laboratory stage to a 15-foot diameter filter pilot plant at the Consolidated Water Power and Paper Company's mill at Appleton, Wisconsin.

In the river aeration process the stream's deficiency in dissolved oxygen is increased and the B.O.D. decreased by diffusing large amounts of air into the river below the point where the waste sulphite liquor is discharged. Results to date show that this system can, under certain conditions, accelerate stream recovery to a marked degree since the diffused air appears to reduce rapidly the B.O.D. of the stream water as well as add a considerable quantity of dissolved oxygen. Both these projects are under the direction of J. M. Holderby and Dr. A. J. Wiley.

Recently a project was instituted at Oregon State College at Corvallis under the direction of Dean Gleeson and Professor Graff to study the economic and engineering practicability of producing high protein fodder yeast from waste sulphite liquor. Already underway, this project will include a complete market survey and economic analysis, a survey of the literature and patent situation and an analysis of the engineering aspects of the process including the preparation of pilot plant plans. Another important factor which will be studied will be requirements for conducting extensive animal feeding tests deemed necessary for establishing the value and feeding limits of the yeast. A full time chemical engineer together with assistants is employed on this project.

Strawboard Wastes

At Purdue University, Prof. Don E. Bloodgood is directing a project designed to find means of treating strawboard waste. His efforts are coordinated with those of Dr. S. I. Aronovsky of the Regional Laboratory of the United States Department of Agriculture at Peoria, Ill., who is interested in reducing the waste by classification of the raw material and in the process of manufacture. Prof. Bloodgood is studying the physical and chemical characteristics of the waste as they bear on treatment and exploring the response of this waste to common and new methods applied to other wastes.

Through the cooperation of the Terre Haute Paper Co., a pilot plant consisting of a Permutit precipitator and a high rate trickling filter has been made available for experimental work. This plant is now being operated by the Council for a six-month test period to determine if the efficiency of these devices for handling strawboard waste warrants further study. A report covering all research to date is now in preparation and will be submitted to members this summer.

Miscellaneous Problems Studied at Rutgers

At Rutgers University, under Dr. Willem Rudolfs, studies have been under way since February of this year. Two engineers and a chemist are employed on this project. Investigations to date have been concerned with wastes from news and chip board mills, odor production resulting from the storage of diluted cooking liquors and rapid biological oxidation of sulphite liquor by recently developed methods found successful in other wastes of similar character. Some preliminary investigations have been made on waste problems resulting from the pulping of rags and jute, and in the future considerable attention will be given other divisions of the industry producing specialties. Most of the work to date has been an evaluation of the physical and chemical characteristics of the waste produced by board mills. Some ten mills have been studied with the purpose of determining similarities and differences in the character of their effluents. Laboratory investigations on the response of board mill waste to treatment methods have been started. It will be the purpose of these to establish basic design figures whereby treatment methods may be intelligently and efficiently applied at lowest possible cost. The improvement and development of simple operational procedures capable of rendering treatment processes workable will be studied along with the process development work.

Louisiana State University Kraft Project

A contract has just been signed with Louisiana State University under which that institution will investigate the treatment of dilute kraft mill black liquors which escape the evaporation process to reduce pollutional characteristics. This project is being coordinated with work along somewhat parallel lines which is being conducted at the University of Alabama and Texas A.&M. by William A. Moggio, the Council's field engineer covering the Southern and South Central regions.

Androscoggin River Project

At Bates College, Drs. Lawrence and Sawyer are investigating the sludge deposits in the bed of the Androscoggin River above Gulf Island Dam to analyze their pollutional characteristics and to develop methods of removing the deposits which are largely responsible for difficulties in streams on which pulp and paper mills are located.

Other research activities will be instituted as the recommendations of the various regional committees become available from time to time. Through the employment of these outstanding institutions, the experience, knowledge and technical ability of scientists and technicians of national standing in the field of stream sanitation, chemical and civil engineering are brought to bear on the industry's problems. This experience and knowledge constitutes an added benefit to the Council and its members apart from the research accomplishments achieved by the fellowships directly. It is evident that continued execution of the program outlined here will result in considerable future stream improvement.

The Editor's Comments

Interested in Export?

As the title of this editorial would indicate, it is addressed to our friends, the manufacturers—in particular to members of the Water and Sewage Works Mfrs. Assn. who already are, or who may be, interested in the possibilities of building a foreign trade.

To aid American industry and business interested in export and/or import the Committee for Economic Development (CED) has produced a special "Handbook on International Trade" as one of the newest of the numerous projects of this unselfish, non-political organization in its efforts to provide American business (especially so-called small business) with aids of various sorts designed to produce better business in post-war America.

With the greatest opportunity in history for American business to establish itself in foreign trade, the CED "Handbook on International Trade" is especially well timed and useful. It is a new and up-to-the-minute guide in export and import practices designed for manufacturers and selling agencies desirous of expanding their international trade or of entering this field for the first time. Brief and succinct, this 100-page guide tells *what* detailed information the exporter or importer should have—more importantly, *where* to get such information, and *how* to appraise and use it.

When one considers that for the first time experts in international trade, representing amongst others the following top-flight organizations, pooled their experience in producing a single authoritative handbook, its worth as a guide becomes the greater emphasized. Some of these organizations are—National Foreign Trade Council, Assn. of Consulting Management Engineers, Bankers' Assn. for Foreign Trade, Chamber of Commerce of the U. S., International Chamber of Commerce, U. S. Dept. of Commerce.

Amongst other things that the handbook explains is—(1) How to define and place responsibility for export planning and operation; (2) Trade restrictions and formalities—what these are, and how to ascertain the details of tariffs, quotas. foreign exchange, control and other restrictions; (3) How trade names, patents, etc., may be protected in foreign trade; (4) How to appraise competition in foreign trade; (5) How to decide, finally, whether or not you should seek export business.

In regard to methods of selling which may be employed in foreign trade, the handbook discusses "Direct Selling" through resident agents, foreign importers, foreign branches or subsidiaries; and "Indirect Selling" through foreign purchasing commissions, export commission houses, export agents, etc. Then follows a discussion of methods of advertising in support of export trade, and the high points of export advertising management.

Under "Special Requirements for Export Operations" are discussed such matters as—(1) Financing foreign sales, credit and collections, types of terms, documents, foreign exchange, etc.; (2) The important part played by the Export-Import Bank; (3) Codifying terms of sales; (4) Preparing shipments, packaging, marking, transportation. Finally, there is an explanation of "How to outline a plan for export operations."

In a like manner the question of "Importing" is dealt with in Part 2 of this 100-page "Handbook on International Trade" which closes with a valuable glossary (Part 3) of revised definitions of principal terms used in International Trade contracts, documents and correspondence. And all of this can be procured from the Committee on Economic Development, 285 Madison Ave., New York (17), N. Y., at the partial production cost of only 50 cents each for this valuable guide. This meager charge is the cost of a compendium of specific information on the "how" of export and import trade, representing the experience of the ten top-flight organizations covering this field—information which no amount of money could heretofore buy, but which has now been collected and published by CED as a public service.

Know Your CED!

This is an opportunity to give voice to our appraisal of the confidence inspiring, unselfish and non-political work of CED, under Chairman Paul G. Hoffman, of South Bend, Ind., which bids fair to become the guiding light of industrial and economic America—a refreshing light set on a straightforward foundation of honesty, integrity, intelligence, and all that comes from confidence inspiring leadership. In fact, CED bids fair to accomplish more in rebuilding good relations between American business and the general public, and in doing more good for American business through its important Research and Policy Committee than has ever been accomplished by any former organization fostered by industry and business. In this direction, making its "Handbook on International Trade" available at a fraction of its cost of production is one concrete example.

What CED did in learning the truth as to what to expect in the post-war business cycle and employment in this country, and its advance planning and programming to re-establish production and employment is already well known to those familiar with its longe range program and post-war planning, but is too little known to America at large. It is indeed re-assuring to know that the activities of CED are now being further expanded, with especial emphasis on the work of its Research and Policy Committee. We have believed for some time that CED is the Moses sent to guide American enterprise out of a wilderness which was to a large measure self created through lack of vision, neglect, selfishness, or all three. If ever this country needed anything it needs CED as we have come to know it, and as we hope all America comes to know it—sincere, sound, progressive and public-spirited.

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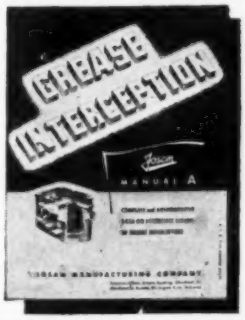

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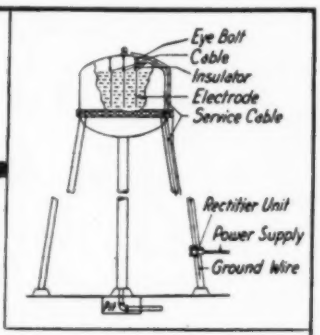

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MEETINGS SCHEDULED:

July 16—CLINTON, ILL. (City Hall)
Illinois Water Plant Operators' Conference. (Central Section.) Secretary, C. W. Klassen, Capitol Bldg., Springfield, Ill.

July 25-27—BATON ROUGE, LA. (Louisiana State Univ.)
Ninth Annual Water & Sewage Short Course. Director, John H. O'Neill, Div. of Public Health Eng., P.O. Box 630, New Orleans 7, La.

Aug. 14—WOODLAND, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

Aug. 26-28—STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Association. Sec'y Treas., I. M. Glace, 1001 North Front St., Harrisburg, Pa.

Aug. 28-30—STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania Sewage Works Assoc. Sec'y-Treas., Bernard S. Bush, Penn. Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 9-11—SAVANNAH, GA. (DeSoto Hotel)
Southeastern Section, A.W.W.A. Sec'y, B. P. Rice, Healey Bldg., Atlanta 3, Ga.

Sept. 12-13—SANTA FE, N. MEX. (La Fonda Hotel)
Rocky Mountain Section, A.W.W.A. Sec'y-Treas., O. J. Ripple, Supt. of Filtration, R.F.D. 2, Littleton, Colo.

Sept. 12-13—PITTSBURGH, PA. (Hotel Roosevelt)
Western Penna. Section A.W.W.A. Sec'y-Treas., E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

Sept. 16-18—ATLANTA, GA. (Georgia School of Technology)
Georgia Water & Sewage School. (15th Annual) Sec'y, Van P. Enloe, Box 363, R.F.D. No. 5, Atlanta, Ga.

Sept. 17-20—POLAND SPRING, ME. (Poland Spring House)
New England Water Works Assn. (Annual Meeting). Sec'y. W. C. Conroy, 609 Statler Bldg., Boston, Mass. (On Sept. 16, a pre-convention get-together will be held in the evening.)

Sept. 18-20—TRAVERSE CITY, MICH. (Park Place Hotel)
Michigan Section A.W.W.A. and Conference on Water Purification. (Joint Conference.) Sec'y-Treas. R. J. Faust, Michigan Dept. of Health, Lansing, Mich.

Sept. 20-21—DEADWOOD, S. D.
South Dakota Water & Sewage Works Conference. (Annual Meeting.) Dir. W. W. Towne, Div. of Sanitary Engineering, State Dept. of Health, Pierre, S. D.

Sept. 22-25—FORT WORTH, TEXAS (Hotel Texas)
American Public Works Congress. Exec.-Dir., Norman Hebden, 1313 East 60th St., Chicago 37, Ill.

Sept. 27-28—LANCASTER, PA. (Hotel Brunswick)
Four States Section A.W.W.A. Sec'y-Treas., H. Lloyd Nelson, 1624 Lincoln-Liberty Bldg., Philadelphia 7, Pa.

Oct. 3-4—ALBANY, N. Y. (Hotel DeWitt Clinton)
New York Section A.W.W.A. Sec'y-Treas., R. K. Blanchard, 50 West 50th Street, New York, N. Y.

Oct. 7-9—TORONTO, CANADA (Royal York Hotel)
Federation of Sewage Works Assns. Exec.-Sec'y, W. Wisely, 625 Illinois Bldg., Champaign, Ill.
Canadian Institute of Sewage & Sanitation. Sec'y-Treas., Dr. A. E. Berry, Parliament Bldgs., Toronto, Ont.

(Continued on Page 75)

MEETINGS SCHEDULED:

(Continued from Page 74)

Oct. 9—BANGOR, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

Oct. 10-12—COLUMBUS, O. (Hotels Fort Hayes — Chittenden)
Ohio Section A.W.W.A. Sec'y-Treas., F. P. Fischer, 811 Perry Payne Bldg., Cleveland, O.

Oct. 14-17—GALVESTON, TEXAS (Hotel Buccaneer)
Southwest Section A.W.W.A. Sec'y-Treas., Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 16-18—ATLANTIC CITY, N. J. (Hotel Traymore)
Pennsylvania Water Works Association. Sec'y-Treas., E. R. Hannum, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 16-19—KANSAS CITY, MO.
American Society of Civil Engineers. Sec'y & Exec. Officer, William N. Carey, 33 West 39th St., New York, N. Y.

Oct. 17—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. (Executive Committee Meeting.) Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

Oct. 23-25—SAN FRANCISCO, CALIF. (Hotel Whitcomb)
California Section A.W.W.A. Sec'y-Treas., Ray L. Derby, Box 3669 Terminal Annex, Los Angeles 54, Cal.

Oct. 28-30—PITTSBURGH, PA. (Hotel William Penn)
Engineers' Society of Western Penna. (7th Annual Conference.) Chairman, H. M. Olson, Wm. Penn Hotel, Pittsburgh, Pa.

Oct. 28-30—KNOXVILLE, TENN. (Hotel Andrew Johnson)
Kentucky-Tennessee Section A.W.W.A. Sec'y-Treas. R. P. Farrell, Dir. of San. Eng., State Dept. of Health, 420 Sixth Ave. N., Nashville, Tenn.

Nov. 7-9—ATLANTIC CITY, N. J. (Hotel Madison)
New Jersey Section A.W.W.A. Sec'y-Treas., C. B. Tygert, Box 178, Newark, N. J.

Nov. 7-9—OMAHA, NEB. (Hotel Fontenell)
Missouri Valley Section A.W.W.A. Sec'y-Treas., M. P. Hatcher, Dir. Water Dept., City Hall, Kansas City, Mo.

Nov. 11-13—RALEIGH, N. C. (Hotel Sir Walter Raleigh)
North Carolina Section A.W.W.A.
(Joint Meeting with)
North Carolina Sewage Works Association. Sec'y-Treas., (both Assns.) Geo. S. Moore, Box 125, Albemarle, N. C.

Nov. 11-15—CLEVELAND, OHIO (Public Auditorium)
American Public Health Association. (74th Annual Meeting.) Exec-Sec'y., Reginald M. Atwater, 1790 Broadway, New York, N. Y.

Nov. 14—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

Nov. 14-15—RICHMOND, VA. (Hotel John Marshall)
Virginia Section A.W.W.A. Sec'y-Treas., W. H. Shewbridge, State Dept. of Health, 1506 Greycourt Ave., Richmond, Va.

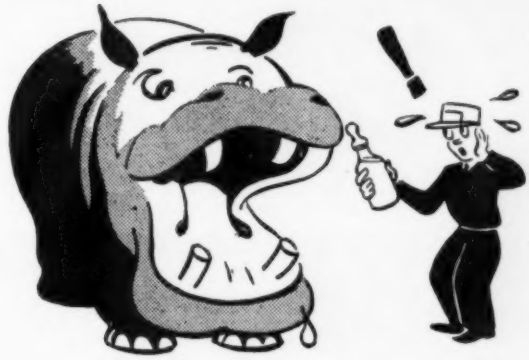
Nov. 15-17—GREEN BAY, WIS. (Hotel Northland)
Wisconsin Section A.W.W.A. Sec'y-Treas., L. A. Smith, Supt. of Water, City Hall, Madison 5, Wis.

Nov. 21-22—(Place not selected)
Florida Section A.W.W.A. Sec'y-Treas., Prof. A. P. Black, University of Florida, Gainesville, Fla.

Dec. 11—AUGUSTA, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

Dec. 19—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. Sec'y-Treas., W. C. Conroy, 609 Statler Bldg., Boston, Mass.

IF YOU HAVE A FEEDING PROBLEM



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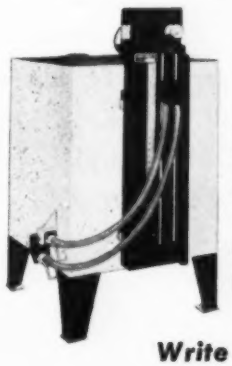

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Better Water—No. 1 of a Series

"VIRGINIA Esotoo is the ideal dechlor,"

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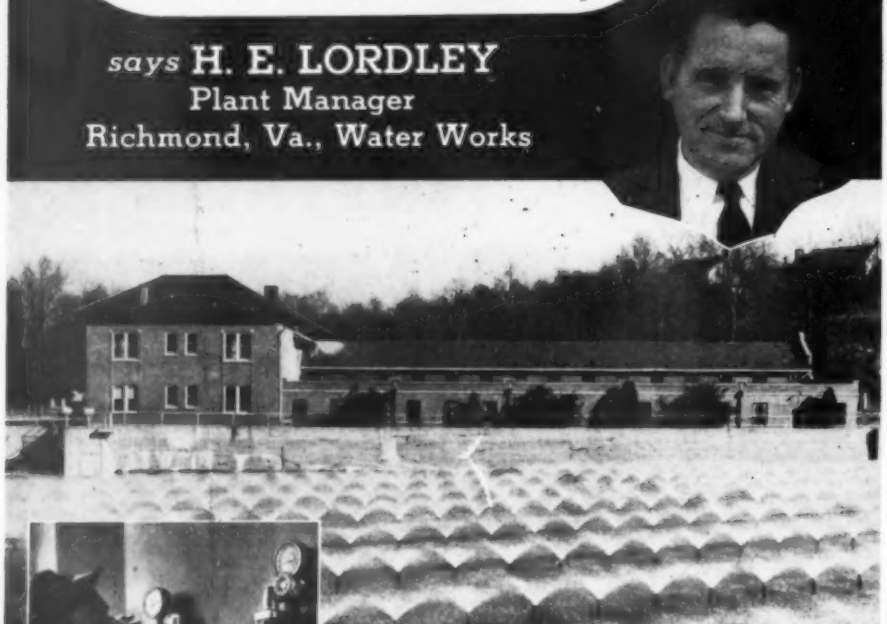

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VIRGINIA "ESOTOO" has been used by the City of Richmond, Va., since 1938. This was one of the first municipal water plants in the United States to attain complete control of dechlorination through use of VIRGINIA "ESOTOO." Special equipment developed at Richmond with the aid of VIRGINIA'S technical staff permits accurate control of chlorine, assuring the City of Richmond a constant supply of palatable water.

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Here and There with Doc Symons

More Memories of AWWA in St. Louis: Hearing George Rohan of Texas tell about the time he took Genevieve to the New Orleans AWWA Convention. Genevieve was a department store dummy, which George placed in the men's room. Each sucker stood around afterwards to hear the next one apologize to the "lady" when he walked in on her.—The number of times the audience applauded at the annual dinner during the presentation of awards, etc.; according to Reg. Hayes it was 109 times—Melvin P. Hatcher in speaking on the subject of annual reports said, "They should not be written on any level lower than that of our water works trade journals"; the audience laughed, I wonder why. —Wendell La Due telling how proud he was to be a Buckeye until he found that the definition of a buckeye is a "smooth nut without any nutrition value"—the 119, not 140 booths; they were so big and attractive that it only seemed like 140.

* * *

The letters some people write to sewage plant operators—for example the following given me by P. N. Daniels, of N. J. Health Dept. —Sewage Disposal Plant, ". . . , N. J. Dear Sirs: Would you be good erough to furnish us with a printed folder outlining the kinds and types of garbage, trash, etc., which you handle by courtesy in the streets of . . . , together with an encyclopedia of instruction as to how it is to be handled, whether or not it should be done up in specially made boxes, tied with silver foil, addressed with a note of invitation, or just what, and accompanied by a time table of the days of the week, month or year and hour at which garbage will graciously be accepted by your aristocracy for paper, tinware, glassware, discarded toys, Christmas trees, cast off love letters and what not?

"It is getting beyond the comprehension of the simple mind as to just what you will accept. . . . We have tried everything we know of short of serving your drivers a turkey dinner to so dispose our debris that it will be acceptable to your Riders of the Purple. . . ." And so on, for another half page or so; all because the garbage collectors failed to pick up a Christmas tree some time after twelfth night.—Let that be a warning to you sewage plant operators who are going into the business of collecting garbage for disposal by grinding at the sewage plant.

* * *

In case you're wondering department. That picture which appeared on p. 112 of the June issue (see item titled "Faces I Missed at St. Louis") is the portrait of none other than his honor the Water Commissioner of Summerfield, The Great Gildersleeve, himself. For some unexplainable reason, the caption that was to have appeared under "Gildy's" portrait, didn't.

* * *

Kay

Speaking of pictures; for those of you who complain that the pictures I take of you are a mess, I should like to ask you to cast your optics at the photograph accompanying this little item. Obviously it is good. Furthermore, I took it. Perhaps what I need for good pictures is good subjects; and I do mean good.

* * *

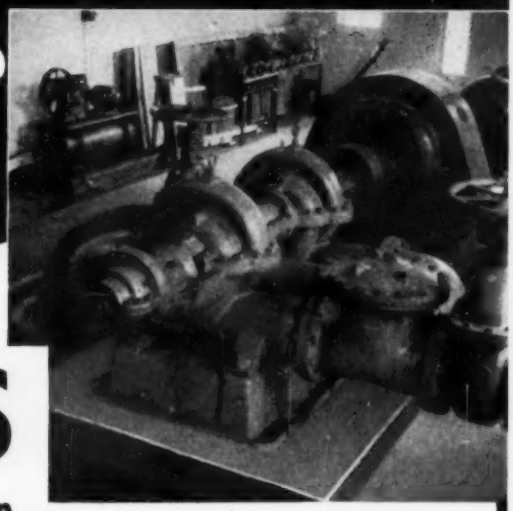
If I were to tell you his name you'd really be surprised, but a well known waterworks man once spent a frantic half hour looking through the excelsior he had just unpacked from a liquid type gage, trying to find a part of the apparatus mentioned in the direction sheet. What was he looking for—The Meniscus. P.S. I don't know his name either, but I know the man who does.

* * *

Where an atom of oxygen counts. N. S. "Joe" Chamberlin of W&T's Tech. Serv. Div. tells the story of the water plant operator who was using superchlorination and dechlorination with sodium sulfite. When he suddenly ran out of sulfite he went to a local merchant for help. The local man had no sodium sulfite but he did have a barrel of sodium sul-

18 YEARS OLD

Yet its efficiency of 87% is unchallenged today



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Every Morris Pump is engineered to give optimum performance under the specific conditions of use. Morris specializes in a very efficient line of large-diameter-impeller, double-suction pumps which are especially suited to meet high head requirements with a fewer number of stages. That is why a 2-stage pump, driven by a 300 H.P., 3-phase, constant speed motor, turning at 1770 rpm was entirely adequate for the Montclair, N. J., job.

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fate, "which should work just as well".—You're right, it wasn't long until W&T received a hurry call for help.

* * *

Some of us who make a living by covering water and sewage works conventions have been a little hard put to find hotel space at times. We were discussing the matter during one of the lighter hours of a recent convention and Frank Roe, now of Chicago Pump Co., said, "You fellows don't know how tough it really is; I went into a hotel recently and the clerk said, 'You want a room and a bath? Mister, I don't even know where you can get a room with a path.'"

* * *

You've gone to a bank, to a Building and Loan Assn., or to the Post Office to deposit money in a savings account, but did you ever hear of banking in a water works? Well, Waynedale, Ind., not only has a modern automatic water system, but the water company operates a credit union as well. Operating under a Federal law, it was started by Chester W. Keen, Supt., when he tossed a quarter on a table four years ago. It now has $25,000 on deposit and pays 3 per cent interest. A gain in assets of 100,000 fold in four years is not bad. Not bad at all! Shows the people have confidence in that water plant.

* * *

Not too long ago, in our June column, to be exact, I mentioned several news letters devoted to the subject of water works. One I didn't mention is the Ohio Section News, edited and published by Ferd Fisher, Secy. of the Ohio Sect. AWWA. In a recent issue of that sheet, Frank Woodbury Jones (Havens and Emerson—plug) asks and answers the questions, "How much water is a million gallons? An acre of ground covered three feet deep, a continuous flow of 700 gallons a minute for 24 hours (Will you settle for 693.1 gpm., Frank?); as coffee enough to furnish the combined population of Akron, Cleveland, Columbus, Dayton, Toledo and Youngstown with four mugsful per person per day for two days." With or without cream, Jonesy?

* * *

While I'm on the subject of News Letters, may I ask that all editors of such, be they issued by state departments of health, AWWA sections, or Sewage Works Assns., please check your mailing lists and put me on, if I'm not already there. I'd like to have a complete listing of all News Letters devoted to both water and sewage.

* * *

I hear tell. 'Bill' Brush has a new assistant over at *Water Works Engineering*, to wit: Doc. William H. Lang, one of Jack Hinman's boys and more recently of the Newport News (Va.) Water Works Commission.—Welcome to the association of typewriter ticklers, Doc.

* * *

International Relations Dept. By the time this appears in print (I write it at least three weeks before it is published) Fred Stuart of Stuart-Brumley, no less, will have made a flying trip (literally) to London to establish representation of the Stuart-Brumley products and equipment in that country.

* * *

Some time back this column printed a letter from Dr. Edward Bartow, listing a number of fellows who had been staff members of the Illinois State Water Survey and at the same

time were musicians of note. Dr. Bartow failed to mention R. C. Bardwell, who played mandolin for the glee club and tooted a big bassoon in the University of Illinois Band—Sorry we left you out, R. C.—Have Dr. Bartow and I missed any more?

Not long ago, our office received a letter addressed to K. G. Wbakigm Wsurie. - - - This columnist will personally give a free subscription to the first person who writes and tells us to whom the letter should go.

[Overflow from the main section]

"Swat That Fly"—Again!

The following letter mailed to us was clipped from the British magazine, *Contractors' Record and Municipal Engineering*. The letter appeared in the Nov. 28, 1945, issue of that magazine and was quite a surprise to us, inasmuch as we didn't know that *Contractors' Record* had reprinted Dr. Symons' article on "Swat That Fly." It is interesting to note that this article has received considerable interest. Following is the letter written to the editors of the *Contractors' Record and Municipal Engineering*:

Sir—Dr. George E. Symons' article, "Swat That Fly," in your issue of October 31, is particularly interesting in that it brings to light a problem in sewage works operation, apparently common in America, but not prevalent in our own country.

In America it may be that the sewage works is registered as a "Black Spot" for the breeding of the common house fly, but like Mr. A. Holroyd in his letter on this subject published by you on November 5, I feel that it should be made quite clear that as a general rule house flies are not present on sewage works in this country in such numbers as to constitute a "public nuisance."

I have visited a very large number of sewage works, large and small, throughout this country at all seasons of the year and, except in the comparatively few instances where the sewage works and the refuse destructor operate on the same site, the house fly is in no sense regarded as a nuisance. On the combined works there is usually a big fly population, but it is undoubtedly due to the presence of "dumps" of house refuse awaiting disposal.

The description of the electric fly traps calls to mind an experience I had many years ago. An enthusiastic salesman called at the sewage works and described in very forceful terms the danger to public health created by the sewage works as a breeding ground for house flies—carriers of disease. He proceeded to display a device which he called by the somewhat sin-

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Have you considered Victaulic for your piping requirements?
Sizes—¾" through 60"
SELF-ALIGNING PIPE COUPLINGS
VICTAULIC
EFFICIENT FULL-FLOW FITTINGS
Copyright 1946, by Victaulic Co. of America

ister title of "The Sing Sing Fly Destroyer."

This consisted of a wire cage resting on a saucer-like base. The cage connected by a flex was fitted to an electric lamp holder and, on switching on the current, the wires of the cage became electrified.

As bait, sweetened water or a small quantity of jam was placed in the saucer, the whole idea being that attracted by the bait the house flies would sooner or later make contact with the live wire of the cage and thus be electrocuted.

Although informed that house flies constituted no nuisance on the sewage works, a fact which was obvious—the salesman, at his own request, was accorded full facilities for a demonstration, and during the course of the day he tried out the device over all sections of the works resulting in a total catch of less than a dozen.

There may have been doubts in our minds as to the efficiency of the "Sing Sing Fly Destroyer," but there was no doubt in the mind of the salesman that "there just aren't any flies to destroy on your sewage works."

As a postcript it may be added that the same apparatus was later demonstrated at the town's refuse destructor and proved extremely successful.

Yours faithfully,
ARNOLD KERSHAW,
Sewage Works Manager,

Borough of Slough,
Sewage Purification Dept.,
Cippenham Lane,
Slough, Bucks.
November 21, 1945.

Perhaps we should advise Mr. Kershaw that so far as we know, sewage treatment plants in America are not "Black Spots" for the breeding of the common house fly, but many sewage treatment works in this country are not too far from municipalities and often near to garbage dumps, where the flies breed. It is probably safe to say that the fly nuisance at American sewage plants is relatively proportional to the proximity of the municipality. Certainly the data on the Buffalo Sewage Works given in the original article should be evaluated in light of the fact that only a canal separates the sewage treatment plant from a portion of the city proper.

British Foot vs. U. S. Foot*

This writer did not know that a U. S. foot is about 3 millionths longer than a British foot until he stumbled across that fact in a book of accurate conversion tables.

Of course the difference is so slight that it is usually ignored, but the difference exists nevertheless, and it caused the writer to do some figuring to enable him to visualize the difference.

We can all visualize a square mile, so, using that as a basis, we find that in a square mile there are 27,878,400 U. S. square feet. But a British square foot is 0.9999942 of a U. S. square foot. Therefore multiplying the former by the latter we get 27,878,238.3 U. S. square feet in a British square mile.

Subtracting the British square mile from the U. S. square mile the difference in area is found to be 162.3 square feet. And 162.3 sq. ft. is equivalent to a patch of ground 12¾ by 12¾ feet—about the size of an average victory garden.

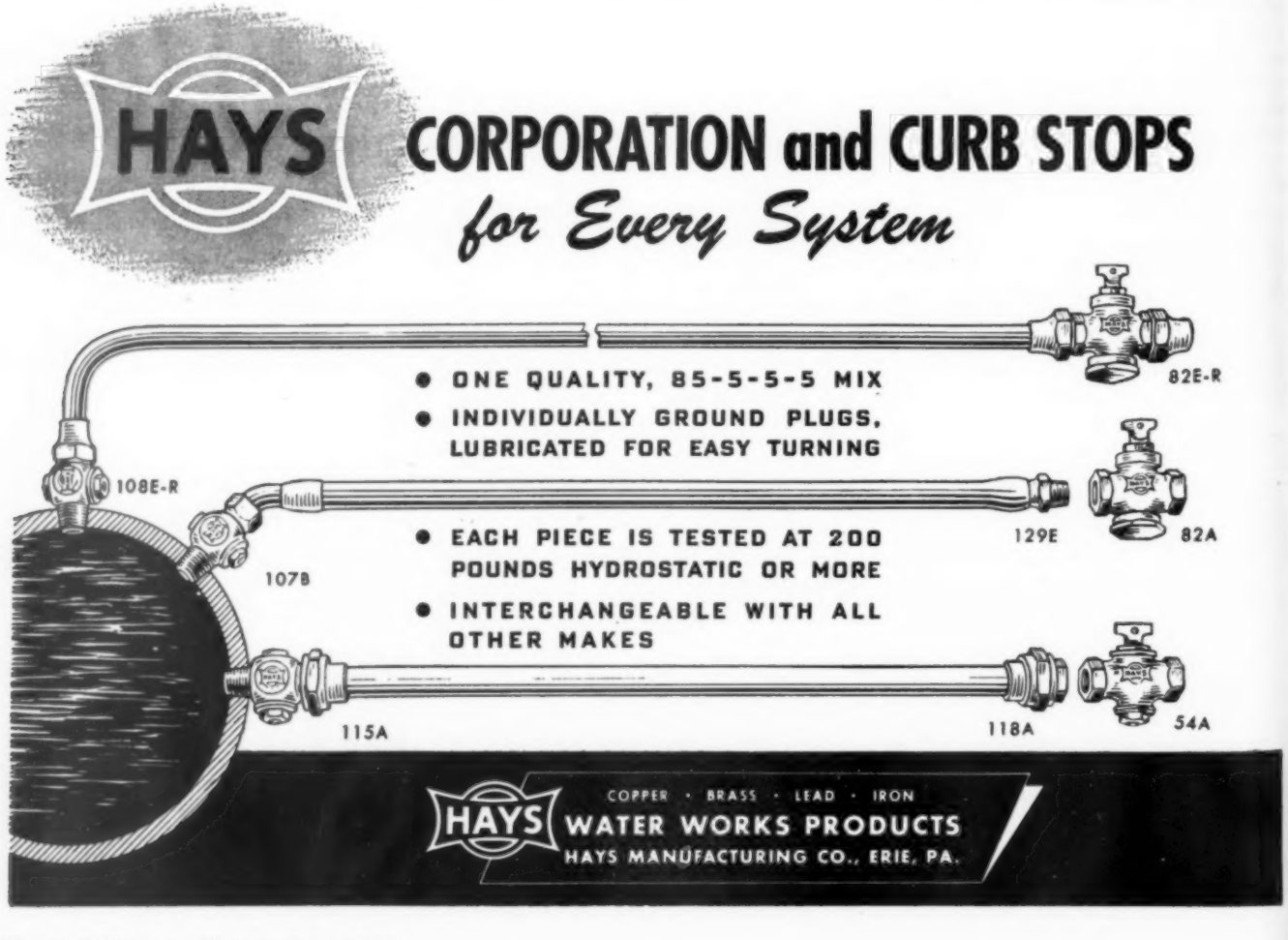
The moral is "Buy in America: Sell in Britain."

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

Recovery of Metals From Spent Wastes

A new method has been developed in the chemical laboratories of the Timber Engineering Co., Washington, D. C., for the recovery of silver from spent photographic solutions. This method is based on the use of a specially prepared lignin, called Teco-lignin S. A small amount of the Teco-lignin S precipitates the silver in the form of a quickly settling sludge from which the metal or its salts can be easily prepared.

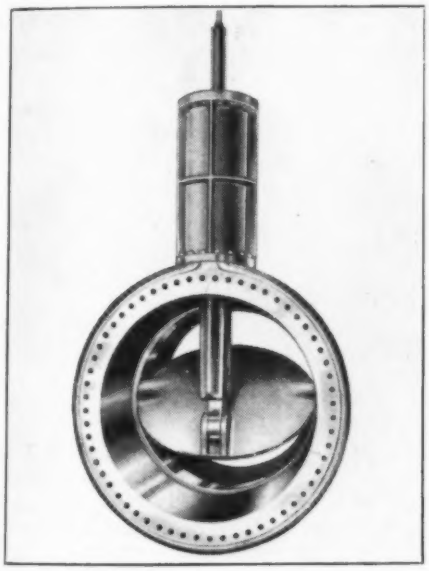
While the new method has been developed for recovering silver from spent photographic solutions it appears to have possibilities for the recovery of other metals from dilute, impure solutions. Perhaps it may offer a method for the precipitation of chromium or other metals which cause difficulty when discharged into sewers or streams.



MANUFACTURERS' and EQUIPMENT NEWS

Disc-Arm Pivot Valve

The accompanying photograph shows a Dow Disc-Arm Pivot Valve. Actually it is not a new piece of equipment because it has been used since 1922 for regulating service, for check valve service and for free discharge service, mostly in power plants and in penstocks. Maybe it isn't a new piece of equipment but it is new to the water and sewage field, and as such rates a comment in these columns.



In view of remarks made by one of the speakers at the N. Y. Section AWWA Meeting in Elmira this Spring, these disc-arm pivot valves should have an important application in water distribution systems.

A bulletin on this valve, which is made by the Chapman Valve Co., contains a section on the standard design, its advantages, its operation, application, and various experiences and recommendations in connection with the use of the valve. The bulletin, List 37, may be obtained from Chapman Valve Manufacturing Co., Indian Orchard, Mass.

Allen Retires as Mathieson Chairman

Edwin M. Allen has retired from his post as Chairman of the Board of The Mathieson Alkali Works but will continue as a director of the company.

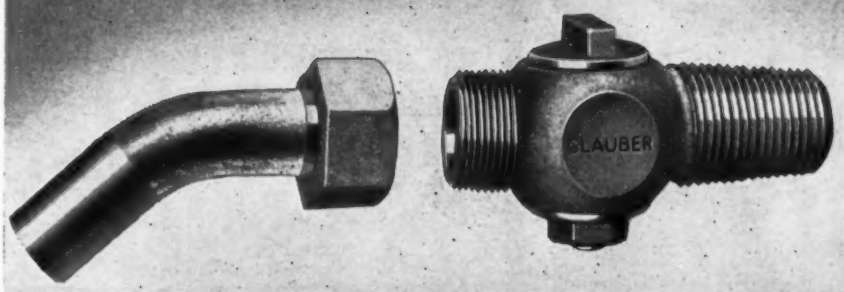
Mr. Allen served as president of the company from 1919 to 1944, and since 1934 has also served as chairman of the board. He retired as president in 1944 to be succeeded by George W. Dolan. With Mr. Allen's retirement as board chairman the position is being abolished.

Much of Mathieson's noteworthy growth and financial strength since World War I may be credited to Mr. Allen's guidance.

Waterproof Coating

A waterproof coating for rough, porous walls has been developed by Truscon Laboratories, Inc. of Detroit. This new coating, marketed under the name of Tite-Wall, may be used on practically any rough, porous surface but especially on concrete and on cinder block. Tite-Wall is mixed with water which makes it

PROFIT by the Quality and Service built into GLAUBER Ground Key Work



1/8 Bend coupling, corporation stops to meet all installation codes . . . also complete with lead wiped joint goosenecks. Other "red brass" ground key work for your waterworks requirements.

THE GLAUBER BRASS MFG. CO., KINSMAN, OHIO
Division of H. B. SALTER MFG. CO., Marysville, Ohio

Glauber RED BRASS
GROUND-KEY CURB and CORPORATION STOPS
LEAD GOOSENECKS and WATERWORKS FITTINGS

economical and it is painted on like an oil paint even on rough surfaces.

When applied in two coats it has remarkable water-resisting properties. The material may be applied with a brush, spray, or roller. It comes in either white or five different tints, packed in one gallon and six gallon steel containers.

Write Truscon Laboratories, Inc., Caniff and Grand Trunk R.R., Detroit 12, Mich., for further information.

Payne Dean Expands Line

Payne Dean & Co. of Madison, Conn., manufacturers of the Dean Gate Operator, have expanded their line of manufacture to include a full line of electric control units for attachment to existing gates and floor stands, as well as portable units for valve operation and complete floor stands, both hand and electric.

Catalogs on various items are obtainable from Payne Dean & Co., Madison, Conn.

Portland Cement Assn. Expands Activities

Appoints Dr. A. Allan Bates Charge Research Development

The Portland Cement Association has announced plans for marked expansion of its research and development activities in the field of portland cement, concrete, and their engineering applications. To improve

Dr. A. A. Bates

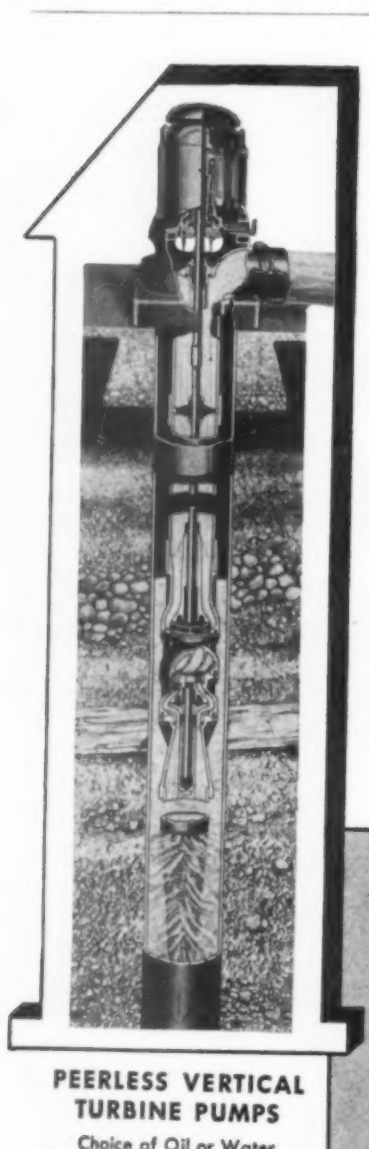
administrative direction and intensify the attack on research and development problems, all such activities are to be handled through a newly created Division of Research and Development, to be administered by a vice president.

To fill this post, the Association has announced the appointment of Dr. A. Allan Bates as Vice Pres. for Research and Development. Dr. Bates, a graduate of Ohio Wesleyan University, Case School of Applied Science, and University of Nancy, France, has been Manager of the Chemical, Metallurgical and Ceramic Research Division of the Westinghouse Electric Corp. since 1938. Dr. Bates assumed his new position on July 1.

Philadelphia Quartz 115 Years Old

The Philadelphia Quartz Co. celebrated its 115th anniversary on July 21st. Beginning as a soap and candle factory established by Joseph Elkinton, the company began the manufacture of silicate of soda in the early 1860's for use in its soaps and gradually became the supplier to other soap makers.

The name Philadelphia Quartz Co. was first used in 1864 when a partnership was formed to produce silicates of soda in a separate plant. The manufacture of soap was discontinued in 1904. The company now manufactures sodium meta-silicate and sodium sesquisilicate as well as other silicates for a wide variety of applications in chemical industry. In the field of water treatment activated



One more reason *why* PEERLESS IS THE WORLD'S LARGEST BUILDER OF DEEP-WELL TURBINE PUMPS

PEERLESS PUMP

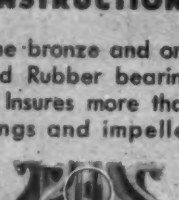
PEERLESS VERTICAL TURBINE PUMPS

Choice of Oil or Water Lubrication. Capacities: up to 30,000 g.p.m.

Also Hi-Lift Pumps for producing small capacities from deep wells; the outstanding development in the decade, for water pumping.

ONLY PEERLESS UTILIZES THE DOUBLE BEARING AND DOUBLE SEAL BOWL CONSTRUCTION:

Double Bearings (1) one bronze and one Goodrich Cutless Fluted Rubber bearing for each pump bowl. Insures more than double life to bearings and impeller shaft. Double Seal (2) mounted below impeller neck (3), is a durable, resilient ring — automatically compensating for wear from abrasives and sand. Assures sealing efficiency.



PEERLESS PUMP DIVISION
Food Machinery Corporation
Canton 6, Ohio · Quincy, Illinois · Los Angeles 31, Calif.
Distributors in all principal cities

silica gel is finding increased use as an aid to coagulation.

The company has nine plants and a subsidiary with three plants in California as well as another subsidiary in Canada.

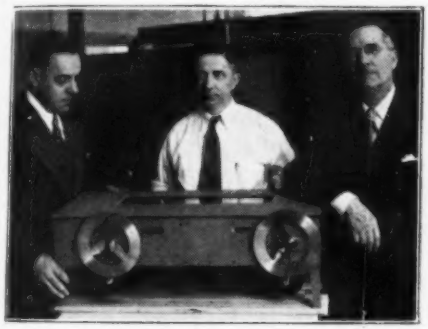
New Diamond Alkali Sales Executives

Fred W. Fraley, Vice President of Diamond Alkali Co., has announced the appointment of W. H. McConnell as Director of Sales, and J. D. Mattern Assistant Director of Sales.

J. Cline McKenna was appointed Manager of Glass Industry Sales, and E. A. Robinson was made Technical Assistant to the Director of Sales.

Leupold and Stevens' 10,000th Recorder

The accompanying photograph shows the 10,000th recorder produced by Leupold and Stevens Instruments Company, Portland, Ore.



This particular unit will be used by the U. S. Engineers' district office at Rock Island, Ill., where it will record and indicate, by a remote registering system, the pool and tail stages at the navigation locks and dam at that point.

The instrument known as the duplex recorder has two position transmitters which send stages of water to the recorder on which they are registered graphically by two pens on a 20 in. strip chart.

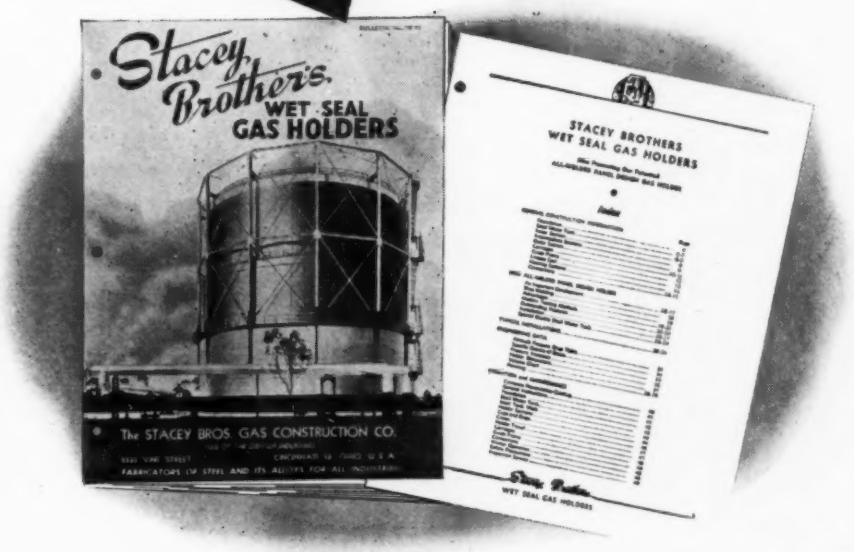
National Lime Assn. Establishes Fellowship at Rutgers

The National Lime Association has established a Fellowship at Rutgers University in the department of Sewage and Waste Treatment. This Fellowship is a continuation of work that has been carried on for some time by the National Lime Association. The Fellowship is under the direction of Dr. Willem Rudolfs who selected R. P. Logan, a former National Lime Assn. fellow, to be directly in charge of the project. Mr. R. Y. LeVine, Ch.E., a graduate student, is carrying out the laboratory work.

The program is concerned with the utilization of various types of lime products in the treatment of industrial wastes. An important phase of the work is the study of the utilization of lime in the treatment of pickling liquor such as is obtained from steel producing and fabricating centers. Particular emphasis is being placed on the difficult sludge problem that is associated with this neutralization. It is hoped that considerable information will be developed regarding means of producing low sludge volume, high rates of dewatering of sludge, rapid settling, etc.

A study is also being made of the neutralization of the various types and mixtures of acids present in industrial waste products, with specific emphasis being placed on methods of avoiding the formation of high sludge volumes.

NOW you can get COMPLETE INFORMATION in this one 52-page book



If you need additional gas-holder capacity—or if you now operate a wet seal holder—*you can't afford to be without this book.*

In it, you'll find detailed construction information, plus operation and maintenance hints—and a wealth of important engineering data.

One complete section is devoted to the famous patented Stacey Brothers All-Welded Panel Design Gas Holder—the most important single construction advance in more than a generation. You'll get *all* the facts—based on our experience in building over 60,000,000 cu. ft. of all-welded capacity.

Your copy of this valuable book will be mailed to you without obligation. Simply write us on your company letterhead, stating the types and capacities of holders you now operate—or plan to install.

STACEY BROTHERS
GAS CONSTRUCTION CO.
One of the Dresser Industries
5535 VINE ST., CINCINNATI 16, O.

Stacey Brothers
ALL-WELDED GAS HOLDERS

Work will also be devoted to a consideration of the various types of equipment that may be employed in the lime treatment; e.g., types of lime feeders, mechanical slakers, sludge production and disposal apparatus, and mixing equipment.

Economy Pumps Expands

Announcement has been received that Economy Pumps, Inc., Hamilton, Ohio, has purchased the Klipfel Mfg. Co. of Chicago. The latter company is a leading producer of pressure regulators, tank thermostat valves, water level controllers, pressure relief valves, pilot operated valves, etc.

The purchase of Klipfel Mfg. Co. gives Economy Pumps Inc. an expanding line of items in the field of fluid flow and fluid flow regulation.

Insulation Resistance Tester

Ideal Industries, Sycamore, Ill., has announced a new instrument for checking insulation resistance in A.C. and D.C. equipment.

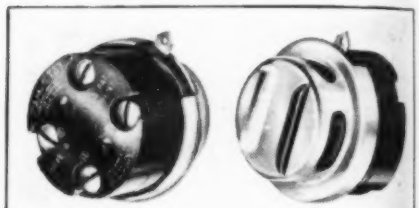
The instrument is entirely self-contained and is ready for instant use requiring no batteries or external power supplies. Correct testing voltage is indicated by two small button lights that glow at 500 volts D.C. The test range is from 0 to 100 Megohms.

Regular use of this instrument will prevent insulation failures that might otherwise cause costly production delays, shut-downs, and expensive repairs.

Further information on the Insulation Resistance Tester may be obtained from Ideal Industries, Inc., 1615 Park Ave., Sycamore, Ill.

New Compact Thermostat

A small compact thermostat for general application at 120-240 volts A.C. has been designed by Cam-Stat

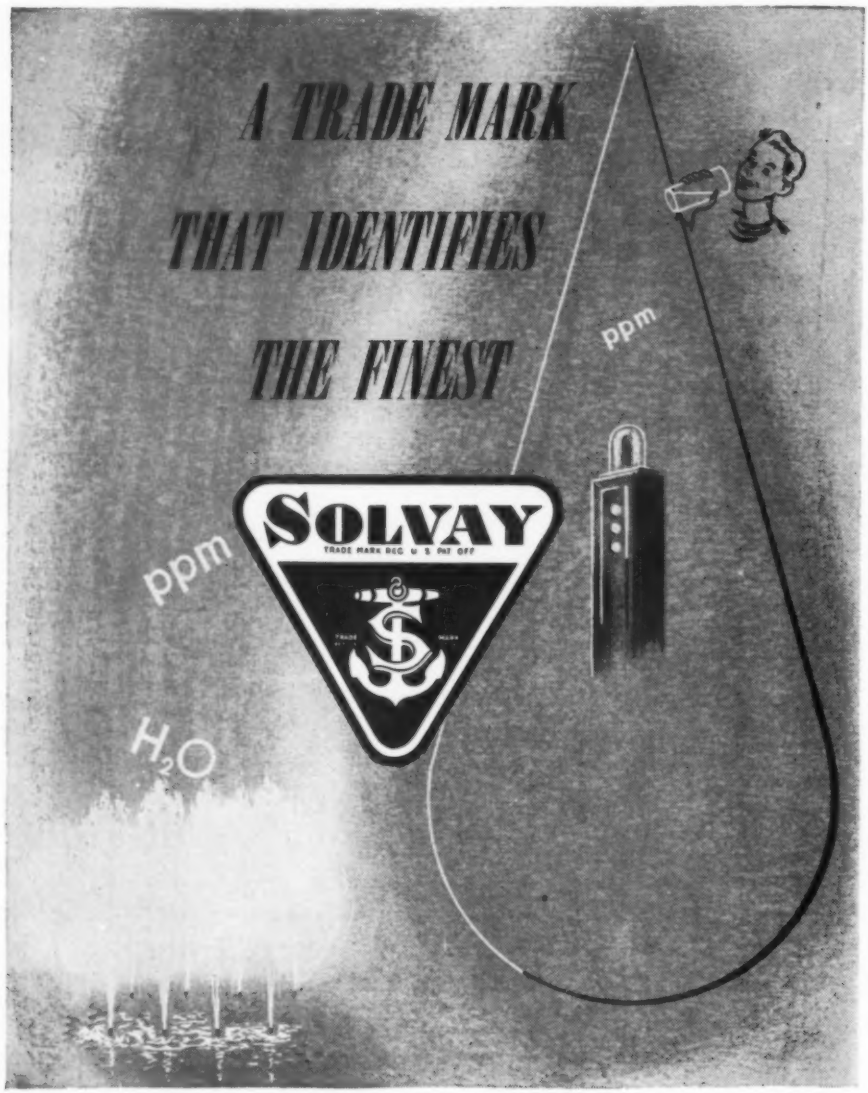


Inc. to meet the requirements of Underwriters' Laboratories.

This unit (1-9/16 in. in dia. and 1-7/32 in. in depth) has a high current carrying capacity (1500 volt-amp) without the necessity of a condenser, low differential (2 deg. F.) and a wide temperature range (—50 to 350 deg. F.). The unit is suited for water heaters, furnace fans, furnace limit controls, and room thermostats. It may be obtained from Cam-Stat, Inc., 2037 So. La Cienga, Los Angeles, Calif.

Penn Salt Builds West Coast Plant

The Pennsylvania Salt Manufacturing Co. of Philadelphia has begun construction of a new $1,000,000 chemical plant on the Willamette River near Portland. The new plant, which will be ready in June 1947, is being built to serve the growing industry of the Pacific Northwest. The



SOLVAY PRODUCTS FOR
WATER CONDITIONING

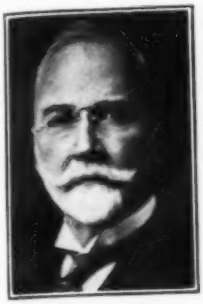
Soda Ash Liquid Chlorine

SOLVAY SALES CORPORATION *Alkalies and Chemical Products Manufactured by The Solvay Process Company*
40 RECTOR STREET • NEW YORK 6, N. Y.

plant will produce chlorine, caustic soda, sodium and potassium chlorate, and sodium hypochlorite.

Former Neptune Meter Co. President Dies

John Herbert Ballantine, retired president of the Neptune Meter Co., died on Thursday, June 6th, after a



J. Herbert Ballantine

long illness. Mr. Ballantine, who was seventy-nine years old, was born in Newark, N. J., and was graduated from Cornell University in 1889.

Besides his widow and two sons, John H. Ballantine, now President of the Neptune Meter Co., and Herbert W. Ballantine, Adv. Manager, Mr. Ballantine is survived by a sister, Mrs. Henry Young, of Newark, a brother, Percy Ballantine, of Lake Wales, Florida, four grandchildren and five great-grandchildren.

Ranson Represents Elect. Mach. in Carolinas

The Electric Machinery Manufacturing Co. of Minneapolis has announced the appointment of Russell Ranson of Charlotte, N. Car., as sales representative for North and South Carolina. Mr. Ranson also represents several electrical instrument and control manufacturers.

Fairbanks-Morse Personnel Changes

Col. Robert H. Morse, Pres. and Gen. Mgr. of Fairbanks, Morse & Co., has announced the retirement of A. E. Ashcraft, for many years Vice President in Charge of Manufacturing. Mr. Ashcraft continues as a director of the company. C. H. Morse, III, Vice President, has been placed in charge of all manufacturing plants and operations.

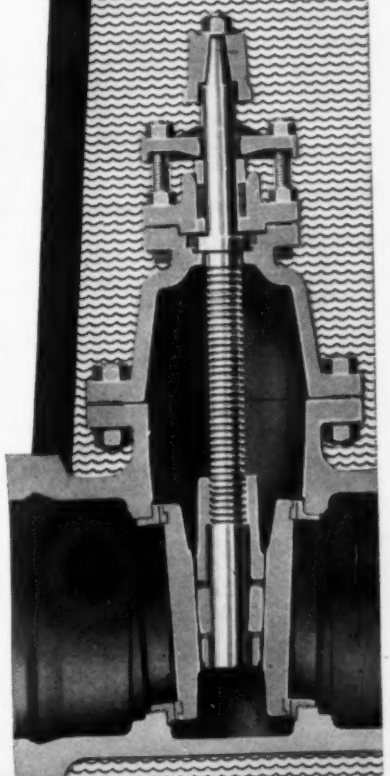
WHAT IF YOUR GATE VALVES FAIL!

Under ground . . . out of sight and reach, gate valves are strictly "on their own." Will they work, if and when that emergency occurs? That is an important question. *They will work*, if they are R.D. Wood Gate Valves—judged by their performance for others, down through the years. These are valves that have stood the test of service; even after years' inaction, they are found in readiness.

R. D. Wood Gate Valves are simplicity itself. Only 3 parts besides the stem, in the internal mechanism—spreader and two discs, bronze mounted. Freedom to turn on the trunnions 360° enables the discs to have new seating contact in each operation. In closing, they take the spreader action from the center, and thus seat themselves without distortion. Flow is full capacity. No pockets to collect sediment.

Made with ends bell or flanged; or to fit other standard-type joints. Of seasoned castings. Meeting every requirement of the AWWA. Tested to 300 lbs. pressure; for severe service up to 175 lbs.

• *In the public interest, R. D. Wood recommends that all gate valves be tested twice a year.*



R. D. WOOD COMPANY
PUBLIC LEDGER BUILDING
INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.
Established in 1803

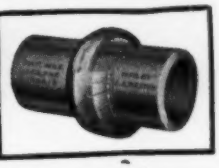
MANUFACTURERS OF MATHEWS HYDRANTS AND SANDSPUN PIPE (CENTRIFUGALLY CAST IN SAND-MOLDS)

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.
Sales Office 140 Cedar St., New York, N. Y. Factory Medford N. J.
Pioneer Producer of GREENSAND ZEOLITE MINERAL

WESTON



GASKET AND FORM
The Perfected Method for Making Sewer Pipe Joints of Cement

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON Adams, Mass.

MORE WATER —LESS WORRY

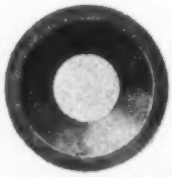
by CLEANING your WATER MAINS using The NATIONAL METHOD

No need to worry about reduced water main capacities just when you need every gallon you can pump. Do as many other communities — large and small — are doing: clean those old clogged up mains by using the NATIONAL METHOD of water main cleaning.

We offer you (1) greater volume of water; (2) lower pumping costs; (3) improved pressure; (4) cleaner water and (5) reduced insurance rates.

Before Cleaning

The NATIONAL METHOD



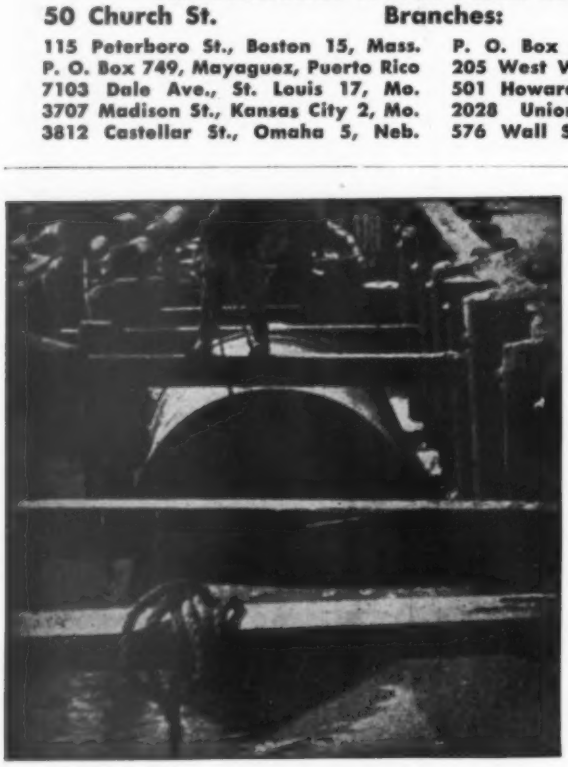
After Cleaning

GUARANTEED TO RESTORE 95% ORIGINAL CAPACITY

The National Water Main Cleaning Co.

50 Church St. **Branches:** **New York 7**

115 Peterboro St., Boston 15, Mass.
P. O. Box 749, Mayaguez, Puerto Rico
7103 Dale Ave., St. Louis 17, Mo.
3707 Madison St., Kansas City 2, Mo.
3812 Castellar St., Omaha 5, Neb.
P. O. Box 683, Jacksonville 1, Fla.
205 West Wacker Dr., Chicago 6, Ill.
501 Howard St., San Francisco, Cal.
2028 Union Ave., Montreal, Can.
576 Wall Street, Winnipeg, Canada



84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 3" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

Henry M. Haase has been appointed manager of the Beloit, Wisc. works of the company, following the resignation of A. C. Howard.

R. H. Owens Vice-Pres. Roots-Connersville

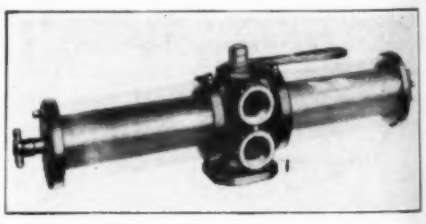
Robert H. Owens has recently been elected Vice-President in charge of Engineering and Manufacturing of Roots-Connersville Blower Corp., Connersville, Ind., one of the Dresser Industries.

R. H. Owens

A graduate of Purdue Univ., Owens has been on the engineering staff of Roots-Connersville since 1925, and has been responsible for many developments in centrifugal blowers and compressors.

Duplex Pipe Line Strainer

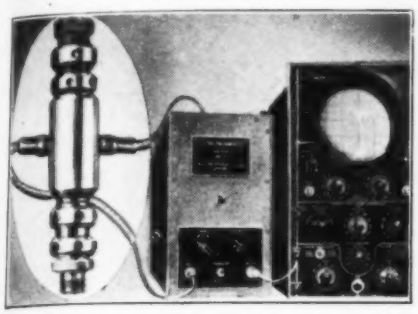
J. A. Zurn Mfg. Co. of Erie, Pa., has announced a new duplex pipe line strainer made with transparent Lucite casing that permits visual inspection. When one strainer unit needs cleaning, the flow can be diverted through the other chamber without loss of pressure and the filled chamber can be cleaned while the pipe line maintains normal flow. The large open area affords free movement of fluids throughout the unit, 16 to 1 ratio being obtained with 12 in. tubes and an 8 to 1 ratio with 8 in. tubes. The flat horizontal design makes the strainer adaptable to low close-quarter installations.



Further information may be obtained from the J. A. Zurn Mfg. Co., Erie, Pa.

New Pressuregraph

Electro Products Laboratories of Chicago has announced a new Pressuregraph. The new instrument provides, with a cathode ray oscillograph, a substantially linear pressure-time curve on the screen, which indicates the performance of any engine, pump, or other device subject to pressure variations. It may be used for studies of all types of internal combustion engines, pumps, compressors, air and liquid pipe lines, etc.



Further details may be obtained from Electro Products Laboratories, 349 West Randolph St., Chicago 6, Ill.

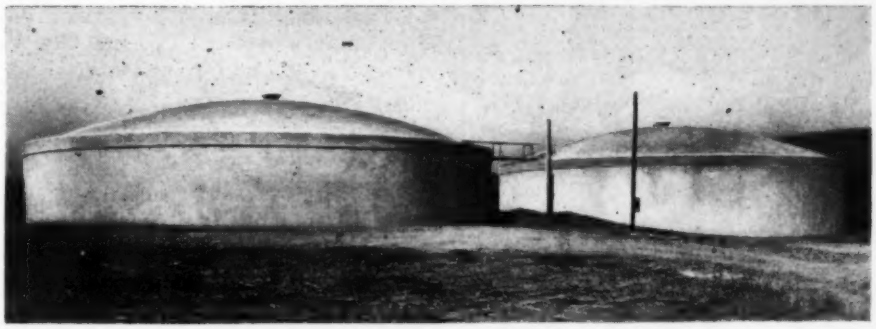
Drastrup Heads Alloy Steel Dept. A. M. Byers

Alfred B. Drastrup has been appointed Manager of the Alloy Steel Sales Department of the A. M. Byers Company. Mr. Drastrup has been associated with the company since 1931 in various capacities. Prior to that time he was with the Columbia Steel Co., and the Gary Works of the U. S. Steel Corp.

A. B. Drastrup

A native of Denmark, Mr. Drastrup was educated in both Denmark and the United States.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.



PRE-STRESSED "GUNITE" TANKS

Above are shown two 80' diameter 750,000 gallon prestressed "GUNITE" water storage tanks with "GUNITE" dome roofs. We built these tanks in 1943 for the Borough of Schuylkill Haven, Penna.

Prestressed "GUNITE" produces a water storage tank which is bottle tight and maintenance free. They may be built either at ground level, completely underground with earth covering over the dome roof, or may be in the form of stand-pipes or elevated tanks.

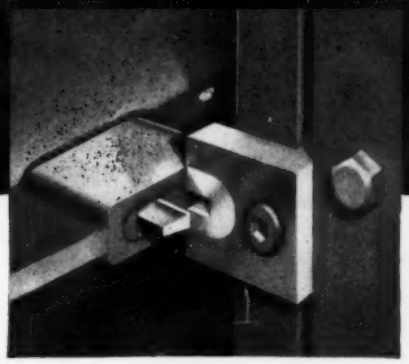
Our experience in this field includes scores of tanks and silos of many types ranging up to two and one-half million gallons capacity.

Our 72 page Bulletin C2300 describes this method of construction fully and also other uses of "GUNITE."

Write for your free copy of Bulletin C2300 today.

MANUFACTURERS OF THE "CEMENT GUN"

This GRIDUCTOR tooth helps improve Sewage Plant efficiency



As this GRIDUCTOR tooth and others like it mesh with a series of cutting bars, sewage solids are carefully cut and screened . . . a step that brings many advantages in the processes that follow.

Because they protect other treatment units from fouling and clogging; *because* their cutting action improves sedimentation in the primary clarifier; *because* GRIDUCTOR-cut solids increase total solids delivered to the digester; *because* this increase in solids in the digester leads to the production of more gas; GRIDUCTORS are proven aids in economical and dependable sewage plant operation.

These GRIDUCTOR advantages are combined with ease of installation in existing screen channels. These advantages explain why GRIDUCTORS have become a really important unit in so many sewage plants. They explain why GRIDUCTORS will continue to be installed in larger and larger numbers where uninterrupted plant service is an essential. The GRIDUCTOR is another product of Infilco research. Ask for more details. INFILCO INC., 325 West 25th Place, Chicago 16, Illinois.

CONSULT INFILCO — FIRST IN WATER AND SEWAGE TREATMENT

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TAPPING MACHINE
VALVE
TAPPING MACHINE
SLEEVE

FOR branch connections specify the Eddy Tapping Valve and Sleeve. These, when used with drilling or tapping machine, insure a trouble-free, water-tight connection. Iron body bronze mounted, tested to 300 lbs. pressure, recommended for anything up to 150 lbs. pressure.

EDDY FOR LONG SERVICE

EDDY
VALVE COMPANY
WATERFORD, NEW YORK

Pump & Tank Co. of Richmond Agents for Hammond Iron Wks.

The Hammond Iron Works of Warren, Pa., designers, fabricators and erectors of steel storage tanks, has announced the appointment of The Pump and Tank Co. Inc., Richmond, Va., as their representative in that area.

V. J. Macklin Joins Neptune Meter

The Neptune Meter Co. has announced that Vincent J. Macklin has joined the company as Sales Engineer. Macklin's territory will be the State of Nebraska with headquarters at the Kansas City office. During the war Mr. Macklin was a Technical Sergeant in the U. S. Signal Corps as a Radar technician and instructor. Eight months of his service was spent on Okinawa.

V. J. Macklin

Penn Salt Experimenting with New Insecticide

The Whitemarsh Laboratories of the Pennsylvania Salt Manufacturing Co. are now making a new insecticide for experimental studies and field tests. The new chemical (hexachlorocyclohexane) is known as 666 and was a British war discovery. Said to be 10 times as powerful as DDT, 666 attacks a whole group of insects not hitherto brought under control. The most promising application is in the destruction of cotton insects.

666 does not have the residual effect of DDT, and its effect on the Psychoda fly is not known but any experimentation on insect control bears watching for its possible application in the field of sewage fly control.

LOW COST
DEMINERALIZED
WATER

WILL REPLACE EXPENSIVE DISTILLED WATER IN THE MAJORITY OF APPLICATIONS

★ Demineralized Water suitable for many requirements demanding distilled water, can now be obtained at a fractional part of the cost of distillation. Belco deliveries are surprisingly rapid.

MODERNIZE YOUR ZEOLITE WATER SOFTENERS

The new Belco zeolite will increase the capacity of industrial softeners up to six times as much. Ideally suited for modernization of present equipment. Belco engineers are always available to help you.

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DIVISION
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CHECK WITH BELCO...first!

Belco
INDUSTRIAL PROCESSING EQUIPMENT
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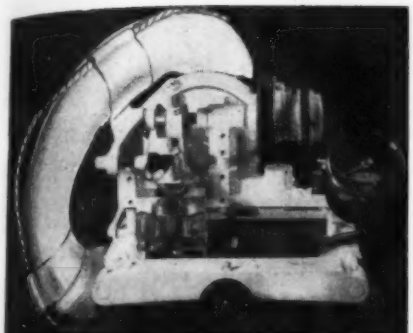

VAR-I-FEEDER'S
Exclusive
LIFE PRESERVER

THE REPLACEABLE RUBBER PISTON RING

The replaceable soft rubber piston ring, an exclusive VAR-I-FEEDER feature, is your assurance of longer life and greater pumping efficiency. By yielding and preventing the abrasive effect of solid particles in solution, this piston ring increases numbers and types of chemicals that can be pumped, and also increases the accuracy of the pumping operation.

The VAR-I-FEEDER rubber piston ring is inexpensive and easily replaceable. It assures perfect contact and minimizes scoring on piston and cylinder walls. It is another exclusive VAR-I-FEEDER advantage designed for extra accuracy, efficiency and endurance.

VAR-I-FEEDER
for
Accurate Chemical Feeding,
Chemical Water Treatment,
Chlorine Dioxide Process,
Taste and Odor Control

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REPRESENTATIVES IN ALL PRINCIPAL CITIES
EQUIPMENT MAKERS AND
PROPORTIONING ENGINEERS

LITERATURE AND CATALOGS

Rotary Positive Blowers

In a new bulletin No. 22-23-B-12 covering many applications for **Roots-Connersville Rotary Positive Blowers,** a culmination of more than 90 years' experience is presented.

The bulletin itself contains sections on the advantages of the positive displacement type of blower, operating principle and characteristic curves, design and construction features, high speed units, specifications, and a table of standard sizes.

The bulletin also contains illustrations and descriptions of installations of the blowers in various water and sewage treatment works, chemical industries, pneumatic conveying service, for tunnel ventilation, mining and smelting, oil refining, foundry cupola service, and many other varied applications. One section of the book shows relief valves and other accessories.

This 24-page bulletin No. 22-23-B-12 may be obtained by writing Roots-Connersville Blower Corp., Connersville, Ind.

Dust Collectors

If you are troubled with dust from activated carbon, alum, lime, soda ash, bentonite, or any other dry chemical used in water and sewage plants, perhaps you may be interested in **Omega Dust Collectors,** described in a folder issued by the Omega Machine Company. This folder, which describes portable self-contained dust collectors, shows typical installations, plans, and elevations, and discusses the various applications, as well as giving principal dimensions and data on the dust collectors.

Write Omega Machine Co., Division of Builders Iron Foundry, 9 Codding St., Providence, R. I., for this bulletin on dust collectors.

Bituplastic

In the **Bitumastic Bulletin No. 43,** published by Wailes Dove-Hermiston Corp. of Westfield, N. J., *Bituplastic,* a new protective coating which can be applied to damp surfaces, is announced. This is the same material that was announced in an Equipment News story in the April issue of *Water & Sewage Works.*

· 1879 ·
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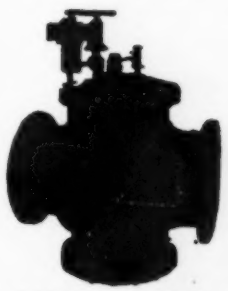
AUTOMATIC VALVES

ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

FLOAT VALVES • REDUCING AND REGULATING VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs, hydraulic control.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.
4. Can be equipped with electric and manual controls.

COMBINATION VALVE
This valve will permit flow in one or both directions acting as
1. Pressure Reducing and Relief Valve.
2. Pressure Reducing and Altitude Valve.
3. Relief and Altitude Valve.



REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

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HYDRO-TITE — the self-caulking joint compound that makes cast iron water pipe joints — strong — tight — flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

FIBREX — The sanitary paper packing that is used like braided jute. Free from bacteria — treated with a water repellent — put up in 60 pound reels. 70 pounds of Fibrex takes the place of 100 pounds of braided jute.

HYDRAULIC DEVELOPMENT CORPORATION
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DRY BRAIDED
Fibrex

STEEL FORMS for CONCRETE METER BOX TILES

You can make excellent meter box barrels at low cost with one of these steel forms. They are made in several sizes and lengths.

Let your post-war plans include making good use of one or more of these forms. Make a start now by asking for information.

FORD
Meter Box Co.,
WABASH, INDIANA

These Bitumastic Bulletins may be obtained by writing Wailes Dove-Hermiston Corp., Westfield, N. J.

Waterproofing Specification Book

A specification book on **Truscon Waterproofings, Dampproofings, and Concrete Specialties** has been issued by Truscon Laboratories of Detroit.

The book is divided into three sections, the first on Waterproofings, including integral waterproofing and iron waterproofing; the second on Dampproofings, including clear dampproofing and bituminous dampproofings; and third, a Miscellaneous section on transparent membrane method for curing concrete, etc. Both complete and short specifications are given, as well as illustrations and description of the various products.

Copies of Book "A" on Waterproofings, Dampproofings and Concrete Specialties may be obtained from Truscon Laboratories, Inc., Caniff & Grand Trunk R.R., Detroit 11, Mich.

Plug Valves

In an eight page bulletin the American Car & Foundry Co. presents **A.C.F. Full Pipe-Area Lubricated Plug Valves.** This bulletin covers the valves in semi-steel, bronze, and other material, and shows the various types of valves available for use with acids, caustics, chemicals, oil, water, sewage, or air, gas, and vacuum. Steel valves are not listed in this catalog, but the company does produce them and solicits inquiries thereon.

Write the American Car and Foundry Co., Valve Dept., 30 Church St., New York, N. Y., for a copy of this latest bulletin on full pipe-area lubricated plug valves.

Axial Flow Pumps

Both **Horizontal and Vertical Axial Flow Economy Pumps** are shown in Catalog No. G845 issued by Economy Pumps, Inc. This 16 page bulletin shows a wide variety of these axial flow pumps in large and small capacities from 500 to 100,000 gpm. These pumps are offered for various applications including flood control projects, drainage, irrigation, dewatering, and condenser circulation.

Catalog No. G845 on Horizontal and Vertical Axial Flow Pumps may be obtained from the Economy Pumps, Inc., Hamilton, Ohio.

GOLDEN-ANDERSON
Design and Build
OVER 1500
TYPES AND SIZES IN
AUTOMATIC
VALVES
For Engineered Protection
on any HIGH PRESSURE
INSTALLATION

● Make Golden-Anderson Valves your first choice on any new or replacement project—for maximum safety, dependability and protection.

Descriptive Technical Catalog on request.

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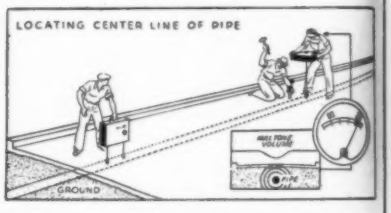
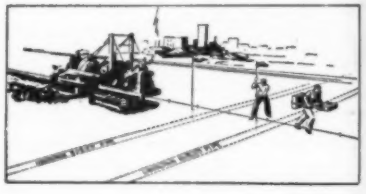
PITTSBURGH 22, PA

M-SCOPE





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16 PAGE BOOKLET FREE UPON REQUEST

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No caulking . . . no need to dig large bell holes . . . . large savings

Haymanite

THE PERMANENT, SELF-SEALING JOINTING COMPOUND FOR BELL AND SPIGOT CAST IRON WATER MAINS

FREE
ILLUSTRATED BULLETIN

Explains: how Haymanite reduces labor and material costs; how any workman can make permanently tight joints; how fewer tools are needed; how leaks are reduced; why vibration is no threat.

Producers also of
M. H. Brand Caulking Lead

MICHAEL HAYMAN & CO.,
INCORPORATED
ESTABLISHED 1869
870 EAST FERRY ST.
BUFFALO, N. Y.

Gage Tester

Have you ever looked at the gage on your sludge line and said, "That can't be right. I wonder if the gage is off." Or have you ever watched the pressure gage on your heating system go right beyond the danger line and still no popoff of the relief? "Is the gage wrong or has the popoff failed?" you asked yourself. What

you need in times like those is a gage tester. Most water and sewage works should have a gage tester, and one that might be considered is described in a bulletin entitled **Twin Seal Check Valve and Twin Seal Unit,** issued by Mansfield & Green of Cleveland.

The accompanying photograph shows the test unit arranged for bench work with test gage. The valve wheel shown is on the small piston for precision adjustment.

The bulletin on these gage testers may be obtained by writing Mansfield & Green, 4601 Euclid Avenue, Cleveland 3, Ohio.

Synchronous Motors

For your motor application file, Publication No. 1068 on the **Selection and Application of Synchronous Motors** has recently been issued by the Electric Machinery Mfg. Co. of Minneapolis. This bulletin is a reprint of a series of articles written for *Electrical Contracting* by A. P. Burris, New York Dist. Mgr. of the company.

This comprehensive treatment of the subject of operating characteristics, power factor, torques, flywheel effect, speeds, excitation, starting KVA, braking, and types of control is well illustrated with photographs, diagrams, and tables.

Write Electric Machinery Mfg. Co., Minneapolis, Minn., for Publication No. 1068.

LEADITE

The Pioneer Self-Caulking Material for C. I. Pipe

Thousands of miles of C. I. bell & spigot Water Mains *are satisfactorily* Jointed with LEADITE

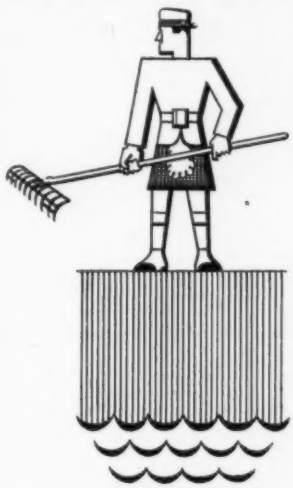
. . . more mi.s. of c.i. bell and spigot water mains are jointed with LEADITE than with any other melted self-caulking material.

LEADITE melts easily, flows around the joint freely, saves time, labor and cost of material . . . and makes a good tight joint that improves with age.

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

RODNEY HUNT'S



"POWER-SAVER"

TRASH RACKS and RAKES

The latest and best in water controlling apparatus. 1. The improved Rodney Hunt POWER-SAVER Trash Rack, with welded Back Bar Construction. Strong, **easy to clean,** quick to install, protected against corrosion. 2. Rodney Hunt's POWER-SAVER Buoyant Trash Rakes, with non-corrosive stainless steel heads, and the new "Feather-lite" tubular handle. Almost effortless operation. For the complete story—

Write today for Bulletins Nos. WCA-146 and WCA-147

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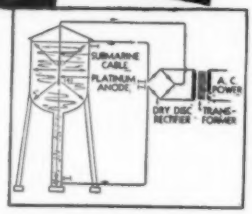
Modern Proved Cathodic Method Provides Lasting Protection Against Rusting — Eliminates Both the Loss of Service, and Cost, of Interior Painting.

Engineered to the individual tank and water conditions Rusta Restor, the modern, cathodic method, maintains the tank in a "neutralized" state that not only prevents rusting but also removes the products of any earlier rusting. Approved and endorsed by national and state authorities. Inexpensive to install. Operation costs two mills ($0.002) per year per sq. ft. of surface protected.



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A DIVISION OF
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★ SAFE ★ RELIABLE ★ QUICK ★

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GLAZED FIRE CLAY TILE FILTER BOTTOM

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COMPLETE WATER TREATMENT EQUIPMENT

F. B. LEOPOLD CO., INC.

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High Pressure Centrifugal Pumps

Catalog No. C-945 titled **Split Case Multi-Stage Economy Pumps** presents important features of design of type EMF multi-stage pumps, as well as details of construction, typical installations, and applications of high pressure centrifugal pumps of the split case multi-stage type. A selection table is included as a table of approximate outline dimensions for different size pumps.

These pumps can be used for high pressure boiler feeding, water supply, industrial plants, or any place where quantities of liquid are to be handled from 75 to 500 psi. and capacities of from 75 to 400 gpm.

Write Economy Pumps, Inc., Hamilton, Ohio, for Catalog No. C-945 if you desire further information on split case or multi-stage Economy Pumps.

Machinery Products

For persons interested in **Machinery Products,** the Ideal Industries Inc., of Sycamore, Ill., has prepared a complete bulletin on the products of this company.

Among the many items of interest shown, described and cataloged, are the E-Z Mark Etcher, Pneumatic Drill, Die Grinder, Riveting Hammer, Dust Collector, Balancing Ways, Machine Shop Etchers, Portable Demagnetizers, Granite Surface Plate, Magnetic Chucks, Grinding Wheels, and Electric Tachometers.

This new catalog may be obtained from Ideal Industries Inc., 1296 Park Ave., Sycamore, Ill.

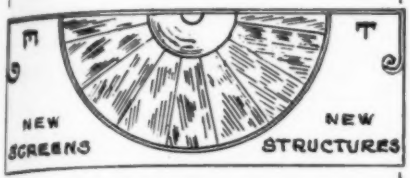
Industrial Gas Masks

In a 4 page bulletin issued by the Mine Safety Appliances Co., the **M.S.A. Industrial Gas Masks** are described. These masks, for protection against individual industrial gases or combinations of gases, smoke, vapors, and dusts, include the "All-Vision" facepiece.

The folder shows the various types of canisters available for protection against industrial gases (with the exception of carbon monoxide and illuminating gas). Also listed are various gases against which protection is afforded. The M.S.A. "All-Vision" facepiece may be equipped with a speaking diaphragm which insures perfect communication over the phone or through speaking tubes.

Write Mine Safety Appliances Co., Braddock, Thomas, and Meade Sts., Pittsburgh 8, Pa., for this new folder on gas masks.

FINE SCREENS
FOR
SEWAGE
AND
INDUSTRIAL WASTES
TREATMENT



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NO COSTLY, POWER CONSUMING REVOLVING BRUSH ARMS—25% GREATER SUBMERGED AREA.

NEW SCREEN PLATES FOR THE ECONOMICAL USE OF A FILTER MEDIA ON THE SCREEN, THUS INSURING GREATER REMOVALS THAN POSSIBLE HITHERTO.

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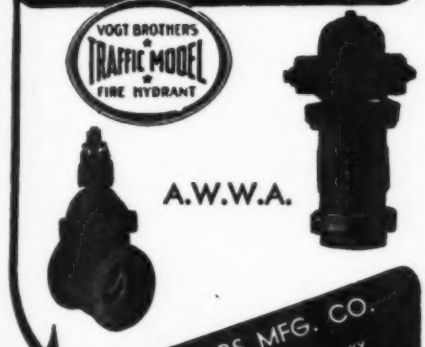

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MIXER

A Size and Type to Fit Your Problem In Water or Sewage Treatment.

WRITE FOR INFORMATION

Vacuum Filtration—String Discharge

According to the announcement from Filtration Engineers, Inc., "The importance of the string discharge in economical continuous filtration, and in handling tough jobs, is one of the many interesting subjects covered in the new Bulletin 101" on *FE Rotary Vacuum Filters* issued by the company. This book includes a dissertation on continuous filtration with the FE Rotary Vacuum Filter discussing such items as the time required to filter, principles of operation, and so forth. A section of the bulletin is devoted to the FE string discharge which lifts the filter categories: Workability and water-cement ratio, bleeding, hardening cake in one continuous sheet and eliminates blow-back and wire winding, thereby allowing the use of lighter filter cloth and saving time in cloth changing.

The bulletin also contains a section on the FE compression mechanism which removes 2 to 5 per cent more moisture, and on FE washing filters where recovery of solubles is desired. Among the typical applications of FE filters shown in the bulletin are chemical, foods, ceramics, metallurgy, paper and pulp, and sewage.

Bulletin 101 may be obtained by addressing a request to Filtration Engineers, Inc., 858 Summer Ave., Newark 4, N. J.

Lead Data Sheet

In case you do not have Standards Applicable to Lead Pipe and Calking Lead these may be found in the March-April issue of **Lead** issued by Lead Industries Association. In this issue appears a Lead Data Sheet for Waterworks Uses, and includes Standards for installing a lead water service, steps for making lead calk joints, and Standards for Calking Lead.

A copy of the bulletin may be obtained from Lead Industries Association, 420 Lexington Ave., New York 17, N. Y.

Clogless Pumps

All wearing parts are accessible and renewable in the **De Laval Clogless and Mixed Flow Pumps.** Described in Bulletin CP-1210 by that name, and issued by the De Laval Steam Turbine Co., these pumps are illustrated by photographs of installations as well as cutaway drawings showing all operating parts. The pumps, in which all passages are free and open, may be

AL BRUMLEY AND
FRED STUART
ARE AT IT AGAIN!

They can't stop talking about the Palmer Filter Bed Agitator . . . because it is such an innovation in prevention of mud balls . . . and in permitting longer filter runs.

Even the Russians approved . . . (and you know how Russians are!) . . . when they came over here to find out how pure, American water is made!

But there's also a new note in Al and Fred's song . . . it's about the AUTOMATIC WATER SAMPLER . . . which takes samples 24-hours a day . . . accurately . . . without an attendant.

SO . . . ORDER NOW FROM
activated alum blackalum

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516 N. Charles St.
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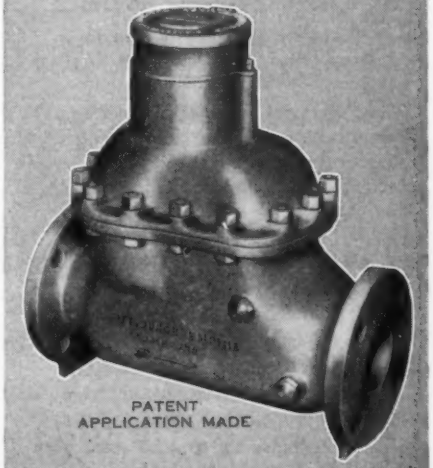
Have you seen?
the PITTSBURGH · EMPIRE
COMPOUND
a revolutionary NEW meter
with many advantages



Ask for Bulletin W-803
Pittsburgh Equitable Meter Division
ROCKWELL MANUFACTURING CO.
Pittsburgh 8, Pa.

ANTHRAFILT
A Filter Medium For All Purposes
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Tegul-
MINERALEAD
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• Sulphur base; quick sealing, speeding laying and backfilling.
• 10 lb. ingot form, easily handled, stored and shipped. Impervious to rain. Cannot change composition.
• Makes permanently tight joints. Goes 3 to 5 times as far as lead, helping conserve a strategic war metal.
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Mertztown Pennsylvania

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JOINT LEAKAGE
WITH
CARSON CLAMPS
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Charcoal iron bolts for Cast Iron Pipe and Fittings.
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South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

obtained with closed or open impellers, and with direct or gear drive for either horizontal or vertical installation.

One section of the bulletin is devoted to De Laval Mixed Flow Pumps, and tables of data are included for both types of pumps. Bulletin No. CP-1210 may be obtained from the De Laval Steam Turbine Co., Trenton 2, N. J.

Single Stage Centrifugal Pumps

Methods of manufacture and testing, applications, installations, construction details and performance are all featured in Bulletin 7057 of the Ingersoll-Rand, Cameron Pump Div. This bulletin 7057 is devoted to **Cameron Single-stage General Service Pumps.** Pointing out that practically every industry requires pumps for some purpose or other, the bulletin presents a series of photographs showing the many and varied applications of this type of pump, from municipal water supply to paper mill stock. Cutaway photographs show the construction of both the large and the smaller sizes. Two tables of performance data are included along with a table of approximate dimensions for various sizes and types of pumps.

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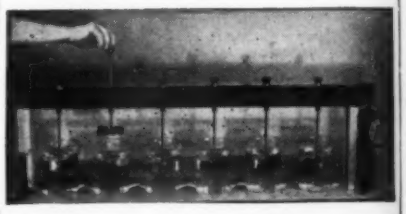
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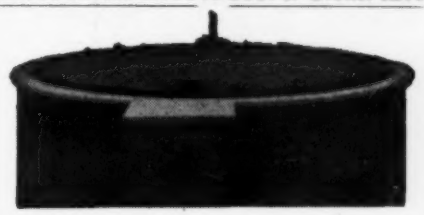
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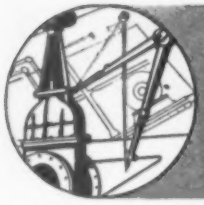

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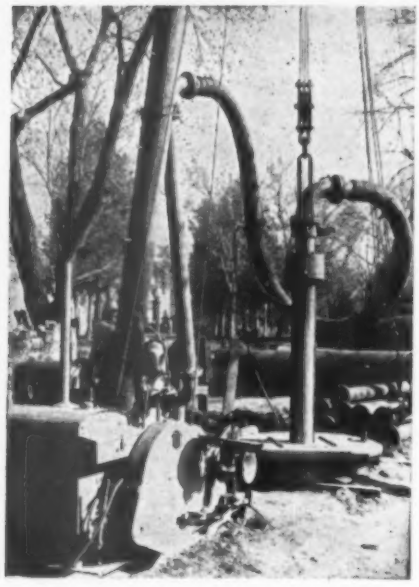

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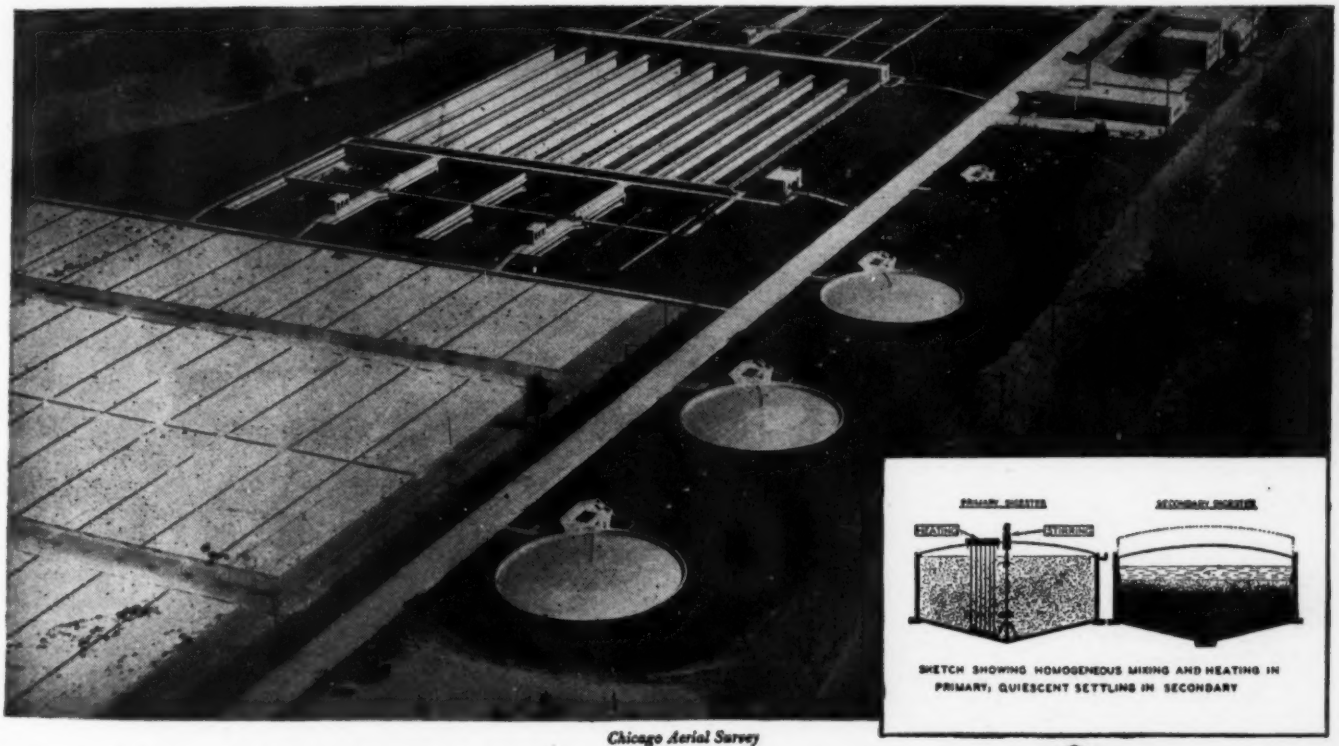
Average gas production of 15 to 20 cu. ft. per pound of volatile destroyed—1/3 or more greater than in non-stirred primary digestion tanks.

Write for complete information, including performance data under various conditions and with all types of sewage sludge.



Chicago Aerial Survey

Aerial view of three 90 ft. Dorr Multdigestion Systems at Gary, Ind. Fixed-cover primary tanks installed below ground level, alongside protruding, movable covers of secondaries, which appear as discs. *Consulting Engineers:* Alvord, Burdick & Howson, Chicago.

SKETCH SHOWING HOMOGENEOUS MIXING AND HEATING IN PRIMARY; QUIESCENT SETTLING IN SECONDARY

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